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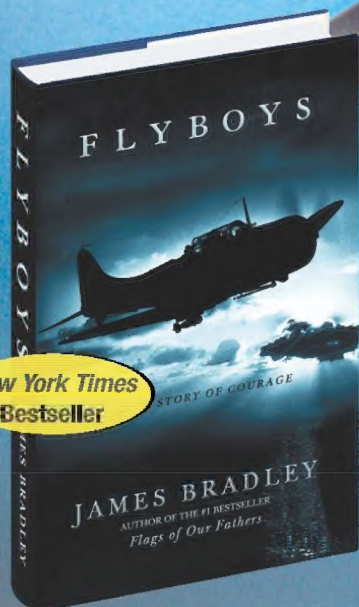
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F-15 Eagle

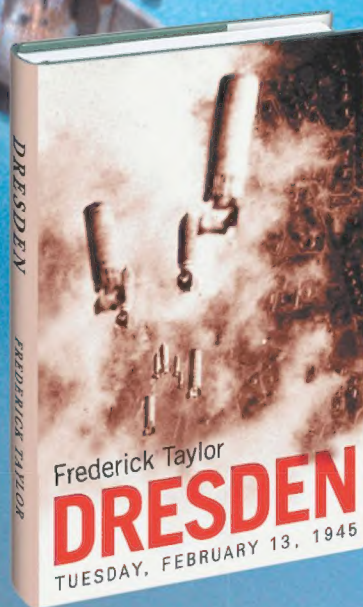
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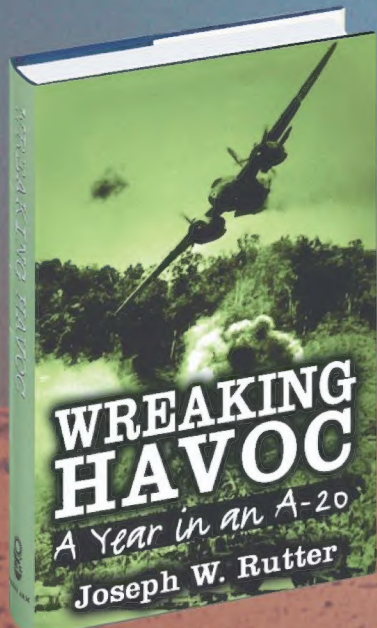
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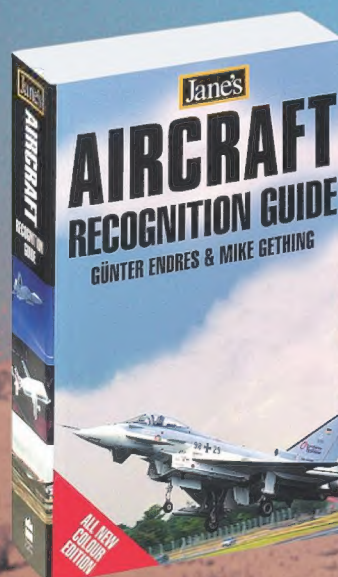
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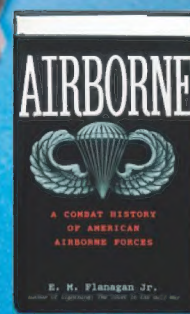
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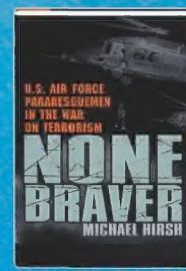
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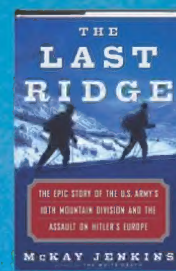
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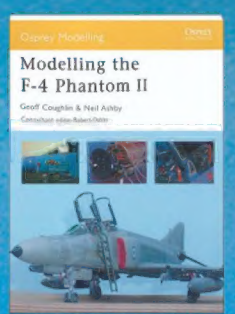
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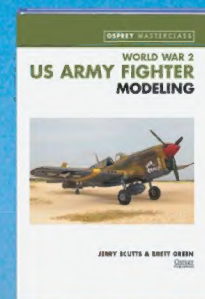
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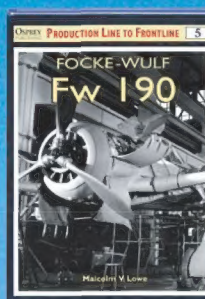
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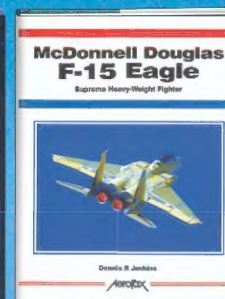
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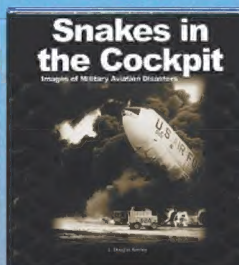
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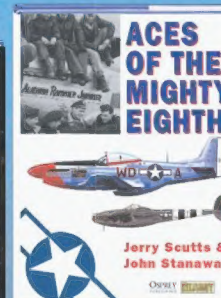
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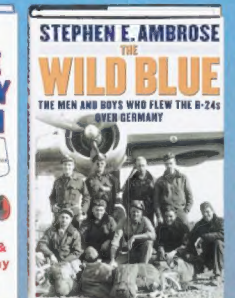
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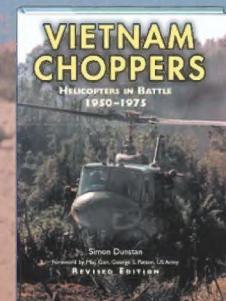
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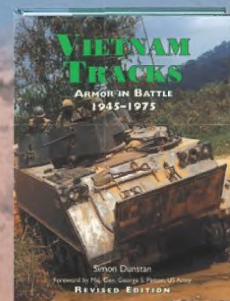
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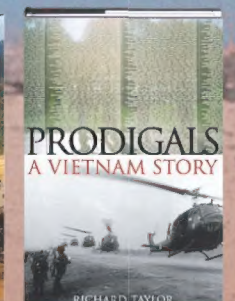
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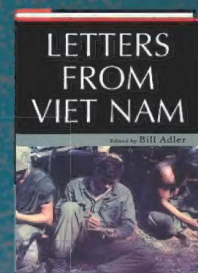


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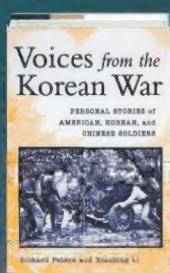
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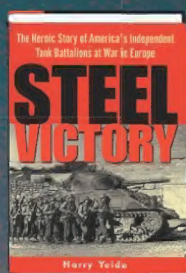
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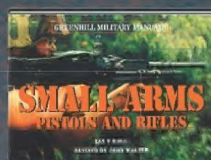
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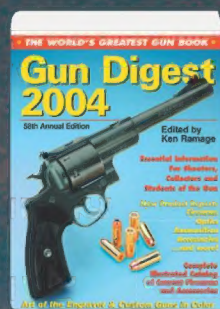
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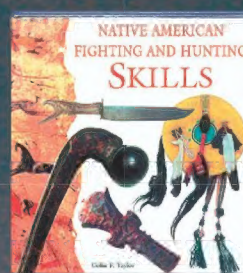
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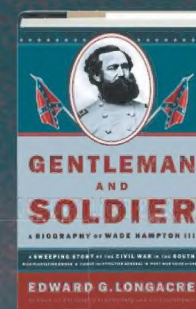
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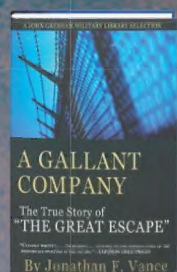
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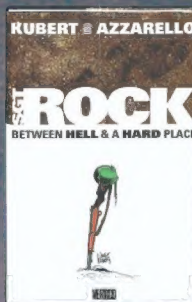
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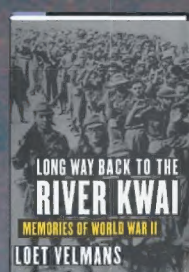
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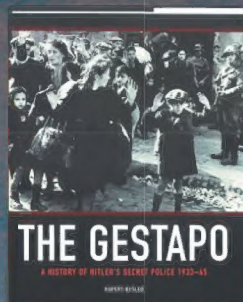
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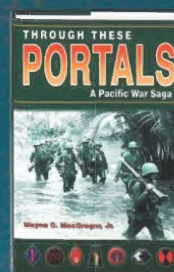
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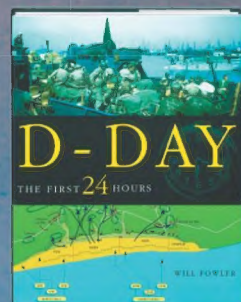
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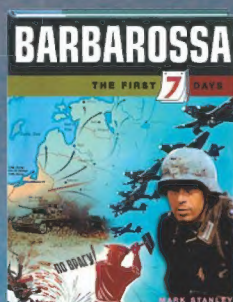
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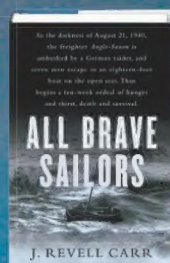
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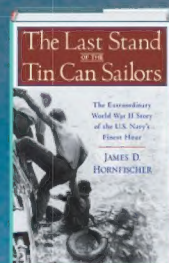
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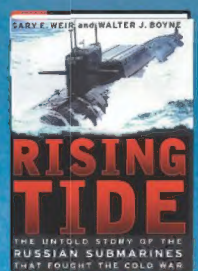


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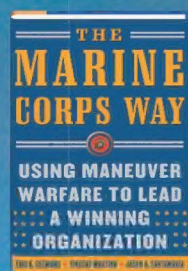
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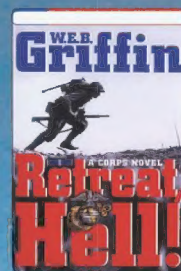
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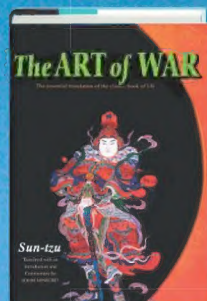
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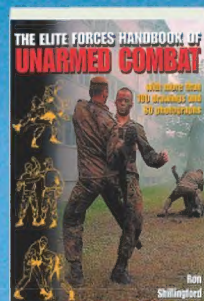
0240++ \$26.95 50¢



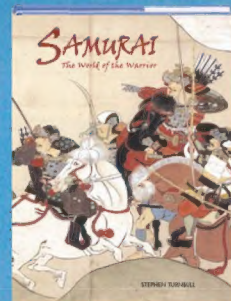
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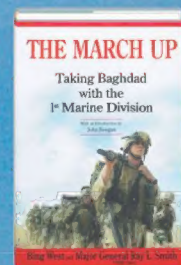
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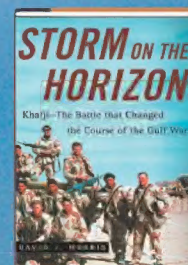
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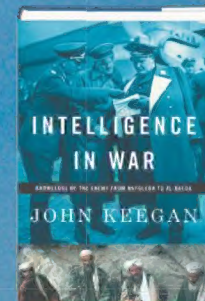
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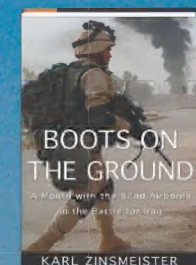
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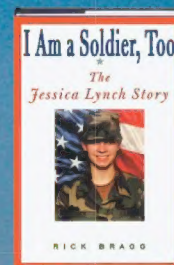
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AIR & SPACE

Smithsonian

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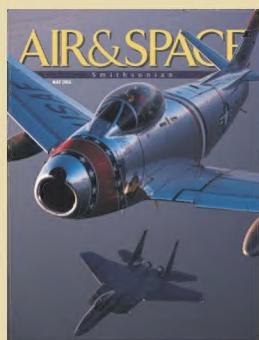
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Cover: For Erik Hildebrandt's camera, an F-86 Sabre sails above an F-15, which inherited the older jet's air superiority role. Many airshows feature such pairings, called *Heritage Flights*.





HISTORY IS NOT ALWAYS WRITTEN QUIETLY. SOMETIMES IT REQUIRES A SONIC BOOM.

No person has pushed the limits of man and technology like Chuck Yeager. The year was 1947. Nobody knew if a fixed-wing airplane could break the speed of sound. More curiously, whether a human could survive the tremendous force of that kind of speed. Yeager was already a legend among WWII fighter pilots when he took off in the X-1 that day. Not only did he reach Mach 1 and create the first man-made sonic boom, he did it again fifty years later in an F-15 fighter. His résumé of military and civilian accomplishments is comprehensive enough to consume chapters in aviation history books. If one person defines what it is to be a man among men, he is Chuck Yeager.



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By What We Give

In 1826, James Smithson bequeathed his entire fortune to the United States to fund an establishment “for the increase and diffusion of knowledge”; 20 years later, the Smithsonian Institution was founded. Since then, many visionaries have provided bequests and gifts to help sustain the Institution’s tradition of excellence in exhibitions, public education, collections, and research through bequests and other legacy gifts—many of which have been designated to support the National Air and Space Museum. With the addition of the Steven F. Udvar-Hazy Center, the Museum has become the largest aviation museum complex in the world. Legacy gifts will play a critical role in shaping the Museum’s future.

I have been fortunate to have spent the last four years as the director of the National Air and Space Museum—a dream job for an aviation enthusiast and pilot. When I walk around either the building on the National Mall or the Steven F. Udvar-Hazy Center, I can feel our visitors’ excitement as they view the treasures in the collection. We draw about 10 million visitors every year, and many of them have a great passion for aviation. I know that among the readers of this magazine there are pilots, aircraft mechanics, aeronautical engineers, veterans of the military services, and countless others for whom aviation has held a special place. As any pilot will tell you, once the love of aviation is in your blood, it never goes away.

During my tenure, I have met many individuals who have included the National Air and Space Museum in their estate plans. When I asked what prompted them to make their gifts, they

gave responses that, although varied, always seem to include something like “I wanted to give something back to aviation because it gave so much to me” or “I grew up with these great airplanes. I want to be sure future generations get to appreciate them as much as I did” or “Maybe some young visitors will be inspired to pursue a career in aviation.”

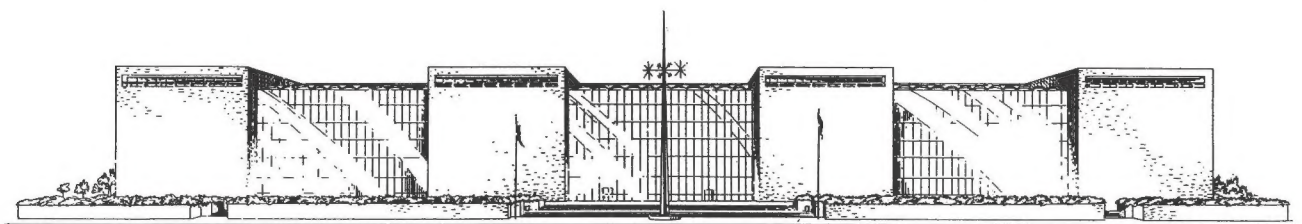
Legacy gifts strengthen the long-term financial stability of the Museum. These commitments, large and small, are highly valued, integral parts of the strong base of learning and understanding that we are building for all current and future aerospace enthusiasts. We deeply appreciate the generosity of all those who have included the National Air and Space Museum in their estate plans, and we are pleased to include them as members of the Smithsonian Legacy Society.

Talking with these members has inspired my wife, Mimi, and me to establish a bequest of our own. It’s a great feeling to know that we’ve made a commitment to the future of a museum that’s dedicated to something that has shaped our lives. To those for whom aerospace has meant a lot, I ask you to consider creating your own legacy at the National Air and Space Museum.

There are many ways to create a legacy gift. An advertisement in this issue describes the commitment Mimi and I have made and provides information on how you can join us.

As Winston Churchill said, “We make a living by what we get, but we make a life by what we give.”

—J.R. Dailey is the director of the National Air and Space Museum.



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LETTERS

That Girl

I am a retired United Airlines captain, and Harry Smith, the pilot of the P-38 rescued from Greenland (*"Glacier Girl,"* Feb./Mar. 2004), was my flight manager. I had some very good years with him; he was a good manager and friend, though he did not talk much about having to land on the ice floe. I am very sorry he died before learning they found his airplane.

Captain Richard Sherman
Lancaster, Pennsylvania

Is *Glacier Girl* now gold or camouflage? The photographs in your article show both colors.

Lt. Col. Melvin S. Halpern
U.S. Air Force (ret.)
Carmichael, California

Editors' reply: Glacier Girl is painted in camouflage. Reflected sunlight makes the aircraft look gold in some photographs.

Remembering the French Cadets

"French Lessons" (Feb./Mar. 2004) aroused a memory of an accident involving some of the French cadets. I was about four or five at the time.

One night, a flight of cadets departed Gunter Army Air Field in Alabama. They flew to Pensacola, then to Brookley Field at Mobile. Shortly after departing there, they encountered deteriorating weather.

At that time, the airway marking system was made up of rotating light beacons mounted on towers spaced at 15-mile intervals. As the cadets flew from beacon to beacon, decreasing visibility became a problem. Five of the crews decided to abandon the flight and land at the airport in Evergreen. At the beacon they believed was at the airport, they circled and descended. The results were disastrous. Five airplanes and 10 men were lost in the woods near Atmore, Alabama. Later, my parents and I drove to the site, and I vividly recall seeing the fuselages, which had been completely destroyed.

I have never understood how the cadets misinterpreted that beacon, but perhaps the language problem that persisted through training was to blame.

David E. McKenzie
Howell, Michigan

France must have had a similar training agreement with the U.S. Navy. I was in primary flight training in N2Ss at Naval Air Station Dallas from November 1942

to February 1943, and I recall French students there.

In the days before Pearl Harbor, the United States was still emerging from the Depression, so not many U.S. high school students drove cars to school and even fewer owned them. But almost all males had driven either the family car, a truck where they worked, or a tractor on the farm, and had acquired the hand-foot coordination needed to operate an airplane's throttle and controls. Apparently, some of the French students lacked these skills. To remedy that, four of them at a time would be assigned a jeep way back in a grassy corner of the field. As we took off and landed, we could see the jeep jerking around back there as each driver took a turn at learning how to let in the clutch and use the accelerator at the same time.

Karl Matthews
Ormond Beach, Florida

In 1943 and 1944, I was a young line boy, or ramp rat, in Tuscaloosa, refueling and winding the starter flywheels of Stearmans for the French cadets. Though we thought they were somewhat arrogant, they were generally well liked, except by the local single men, and particularly the male students at the University of Alabama. Since most young Alabama men were away fighting, the college boys were generally very young or had some handicap. The girls also outnumbered the boys, so their selection pool was limited.

In 1943, Alabama residents had seen few Europeans, so the exotic young men with their handsome uniforms and their romantic French ways overwhelmed the coeds. At the same time, the cadets were beguiled by the charm of the Southern girls. Pretty soon, the cadets were coming into town at every opportunity, and at one point my friend's drugstore ran completely out of condoms. The girls were sad to see the French cadets move on to Montgomery and back to France, but needless to say, the local boys were not.

Richard Bibb
Huntsville, Alabama

Balance Correction

William Burrows' review of *Light This Candle* (Reviews & Previews, Feb./Mar. 2004) states that Alan Shepard "assured his place as the first American in space" by getting surgery for a severe balance problem. Shepard didn't develop

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AIR & SPACE

LETTERS

symptoms of Meniere's disease until 1963, two years after that historic flight, and he underwent ear surgery to correct the condition in 1968.

Thomas J. Frieling
Bainbridge, Georgia

The Chemical Solution

I was shocked at the inaccuracies in "Electro-mechanical Deicing" (How Things Work, Feb./Mar. 2004). First, the electro-mechanical system is not the first ice protection technology to receive certification from the Federal Aviation Administration in 50 years. Many types have been certified in that period. My company produces the chemical anti-icing/deicing equipment your article briefly mentions, known as TKS Ice Protection. Though invented over 60 years ago, it has been continually improved and refined since then.

The statement that chemical systems can be used only in unforeseen and emergency situations is also false. Though we sell systems that are certified for only those circumstances, we also sell a number of systems that are certified for flight into known icing conditions. And our system protects the entire airframe. The Hawker HS 125 family of business jets has used TKS exclusively for its entire 40-year product life. In the mid-1990s we certified the Mooney M20M and M20R for flight into known icing conditions; in fact, the M20R was the first normally aspirated single-engine aircraft to be certified for that. The Raytheon A-36 Bonanza, the Baron, the Cessna 210 and 208 Caravan, the Commander Aircraft 114, and the Commander 500 are all likewise certified.

Kevin E. Hawley, President
Aerospace Systems &
Technologies Inc.
Salina, Kansas

The Earliest Flying Wing (Take 2)

In a recent correction (Letters, Feb./Mar. 2004), you state that the first flying wing in the world was built by the Hortens and flown in 1937. The V-shaped, tail-less aircraft built by John William Dunne (starting in 1910) may qualify as the first, even though they were biplanes. And though semi-circular in planform, the Arup S1 of the early 1930s could be called a flying wing too.

Elwyn Aud
Broken Arrow, Oklahoma

Meadowlark Memories

After I purchased a house in Huntington Beach, California, I found, much to my delight, that I was under the pattern for Meadowlark Airport (Sightings, Feb./Mar. 2004). I enjoyed the variety of aircraft, and the little cafe in the office was a great place for a burger and airplane watching. It was a sad day when we learned that Meadowlark was to close. I think everybody that had ever been in Meadowlark flew in for a final time. Even the Goodyear blimp shot a touch-and-go.

Joe Drasgow
Crystal River, Florida

The Hard-Working Jetex

Perhaps reusable model-rocket motors aren't quite the innovation that Preston Lerner suggests ("It's All About Fire, Smoke, and Noise," Dec. 2003/Jan. 2004). In the early 1950s, a British motor called the Jetex was sold here. The palm-size unit was almost exactly like the motors Lerner described: an aluminum tube loaded with a propellant slug, with a sealing ring and exhaust hole clamped over the business end. Though failures to ignite were frequent, I used Jetexes to power many a model airplane.

I have no idea what chemicals were in the propellant, but I can still smell the exhaust.

John Lowry
Terre Haute, Indiana

Correction

Feb./Mar. 2004 "The People and Planes of Santa Paula": Steve McQueen's flight instructor was Sammy Mason of Santa Paula, not Mike Dewey.

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Smithsonian
National Air and Space Museum



— GENERAL JOHN R. DAILEY,
USMC (RET.), AND HIS
WIFE MIMI
In front of the Museum's
Boeing F4B-4. Dailey's father
and his inspiration, USMC
Brig. Gen. Frank Dailey, flew
the very plane that's now in
the Museum's collection.

PHOTO: CAROLYN RUSSO

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To celebrate the **Centennial of Flight**, the National Air and Space Museum opened its companion facility, the Steven F. Udvar-Hazy Center, on December 15, 2003. For Museum Director John R. "Jack" Dailey, the opening of this facility was the culmination of a dream and of many years of effort.

Dailey, a highly decorated pilot and a leader in the Marine Corps, at NASA, and now at the National Air and Space Museum, is leading the expansion of the most visited museum in the world. To commemorate the opening of the Udvar-Hazy Center and the Centennial of Flight, Dailey and his wife Mimi have made the National Air and Space Museum a beneficiary of their will, making them members of the *Smithsonian Legacy Society*.

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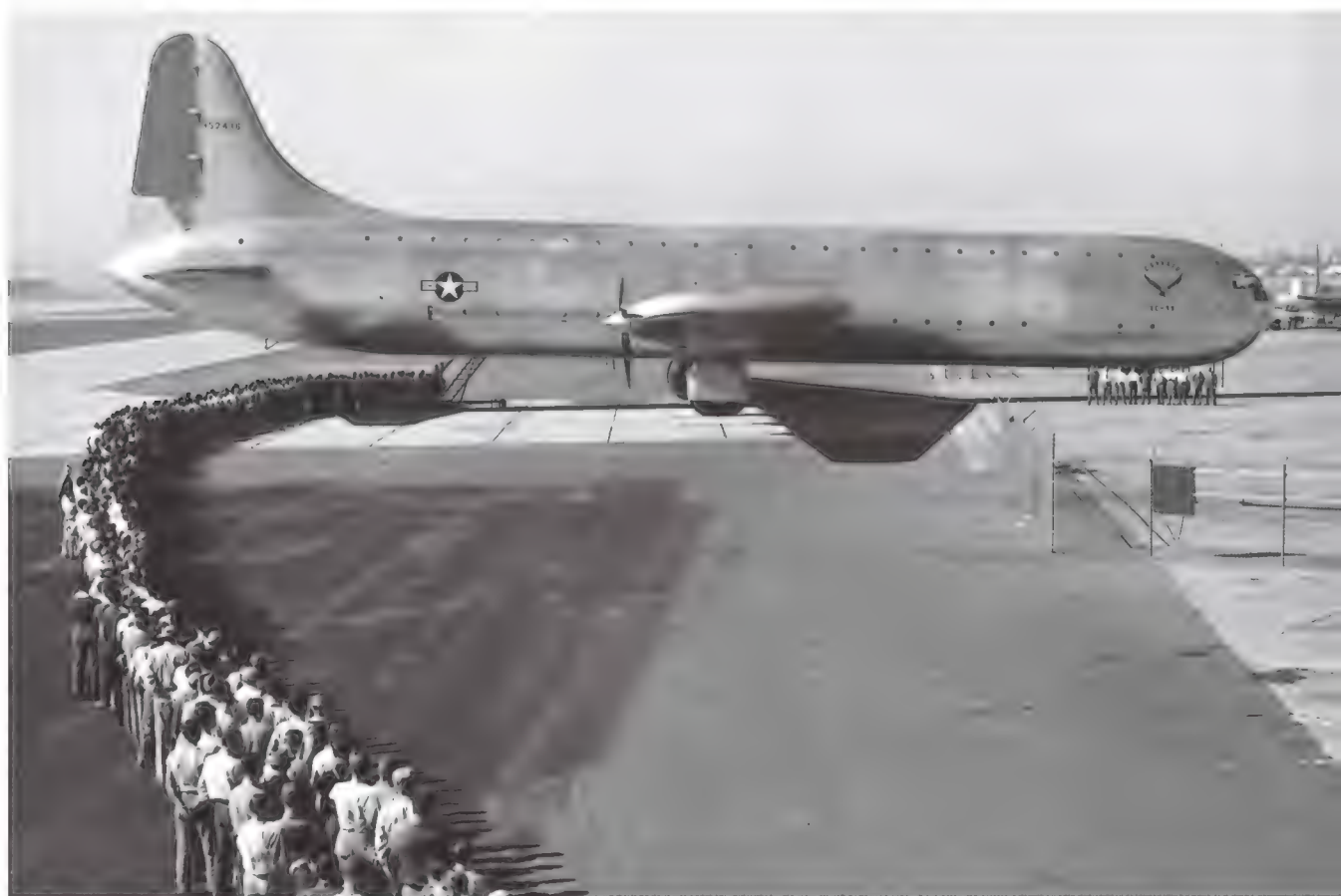
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An Un-Jolly Green Giant

In its day, the Convair XC-99 Super Transport was a monster. Its 230-foot wingspan and six pusher engines were borrowed from the Strategic Air Command's B-36 intercontinental bomber. The fuselage was similar, but was stretched to 185 feet and double-decked to carry 400 soldiers to the front or 335 casualties home, along with 35 attendants and a crew of 10. Convair promised that the C-99 could haul 50 tons across the Atlantic without refueling. Pan American World Airways was so awed that it ordered 15 to be modified as airliners with sleeping berths, lounges, and designer interiors.

Alas, the XC-99 remained a one-off, made obsolete by the smaller and faster family of Boeing 707 turbojets. Though the "X" in its designation indicated "experimental," the Super Transport went into service in 1949, doing odd jobs with the Seventh Bomb Wing at Carswell Air Force Base in Texas. It retired eight years later, having logged 7,400 hours, and was left to molder on the back lots of Kelly Air Force Base in San Antonio.

Over the ensuing years, the XC-99 suffered various indignities. A windstorm blew scaffolding against the fuselage. The nose radome was smashed by some other blow. The wing's leading edges were pummeled, the rudder came to



Convair employees await a tour of the XC-99. Despite company enthusiasm, C-99s never went into production, and the XC-99 was left to molder at a San Antonio air base.

resemble a tattered flag, and the horizontal surfaces turned a dark, greenish brown. "She hasn't been moved an inch in many years," says Don Carey, who maintains an XC-99 Web site. "She just sits there holding the grass down and looking like a monument to how not to preserve an aircraft." In 2001, the city of San Antonio acquired most of Kelly as an industrial park, while Lackland Air Force Base next door absorbed the flight facilities and runways, including the derelict transport.

Last year, the U.S. Air Force Museum in Dayton, Ohio, which already owns a Convair B-36J but will have room to spare in its new hangar, came to the rescue. "It's one of a kind," says Lieutenant Gailyn Whitman of the public

affairs office, "and the largest cargo plane ever built for the Air Force."

That's large in terms of wingspan. The Lockheed C-5 Galaxy that will carry the XC-99 to Dayton is bigger by every other measurement. Even so, the XC-99 must travel in pieces, with the breakdown entrusted to Ben Natrass at Worldwide Aircraft Recovery of Bellevue, Nebraska. "We're working on the peripherals," Natrass says. "We've taken off the elevators, the vertical tail, the leading edges, the access doors—[we have] a pile of parts." Next come the outer wing panels and the six enormous Pratt & Whitney Wasp Major engines. Stacked on pallets, the parts will be transported by C-5s, then reassembled in Dayton.

—Daniel Ford

UPDATE

Vulcan Restoration Gets an Amber Light

The Vulcan to the Sky project at Bruntingthorpe airfield in England has been granted a Stage One Pass for funding from the Heritage Lottery Fund ("God Save the Vulcan!," Dec. 2003/Jan. 2004). The fund has set aside an equivalent of nearly \$3 million to undertake the restoration to airworthiness, but Vulcan to the Sky must now pass Stage Two to secure the grant. The Heritage Lottery Fund requires VTS to raise another \$1 million on its own, in addition to the \$2 million it has already raised, before beginning the restoration.



MARK WAGNER/AVIATION IMAGES.COM

"And Then There's This Bridge in Brooklyn..."

If President Bush is really serious about colonizing the moon, he'd better be prepared to deal with Dennis Hope. Hope says he owns the moon. Okay, so there is the 1967 United Nations Outer Space Treaty, which forbids governments from claiming ownership of out-of-this-world property. But Hope says there's a loophole: The treaty neglected to mention individuals or corporations. That led Hope, a fast-talking former ventriloquist and car salesman, to claim ownership of the moon in 1980.

Since then he's been selling it off piece by piece, taking in \$7 million in the last 24 years. Some buyers got in early: Prior to December 2000 he sold 1,777-acre parcels for around \$10, but since then he's been meting out mere one-acre lots for \$19.99, plus \$1.51 "lunar tax," and \$10 for shipping and handling. To date Hope has sold 3,500 properties for a total of 410 million acres.

"We work like any other development company," he says. "We select an area, print deeds, and then randomly select another area." Landing sites for past U.S. and Russian missions have been deemed "celestial reserves"—lunar historical sites—and aren't for sale. "Imagine if people were allowed to request land. Everyone would ask for the Sea of Tranquillity," he says.

Some say Hope is a few cards shy of a deck. Sa'id Mosteshar, a space law expert and principal partner in the San Diego, California law firm Mosteshar Mackenzie, says that when the Outer Space Treaty says "government," it means the government's citizens. "There is no system of law on Earth that will allow him to enforce a property right in outer space or any celestial body," Mosteshar says.

"Do you think anyone owns the moon?" says Steve Durst, director of the Lunar Enterprise Corporation and an editor at Space Age Publishing. "It's obviously a fantasy." He adds, however, that Hope is providing a useful and educational service. If humans actually do colonize the moon, they're going to want to own land. Durst even admits he's hedging his bets. "I have four separate deeds myself dating back to 1970," he says, though he adds, "I don't regard them as very valid." One of those deeds is from Hope's company.

None of this shakes Hope's faith in his moon mission. "I'm the first one to

understand the incredulousness [*sic*] of what I'm doing," he says. "But the claim is based on logic, and it has legal principles." Then again, a scan of Hope's Web site, www.lunarembassy.com, reveals a tongue-firmly-in-cheek tone, suggesting that Hope finds the selling of lunar property simply to be great fun. And the deed makes a great gag gift.

—Phil Scott

WORK IN PROGRESS

Vought's Old Yeller

Last November, after weathering an 1,800-mile flatbed trailer ride from the National Air and Space Museum's Garber storage facility in Maryland, the proof-of-concept vehicle for Vought's XF5U-1 fighter, the V-173, arrived at the Vought Aircraft Heritage Foundation's hangar at the Vought Aircraft Industries plant in Grand Prairie, Texas.

Built in 1942 with Navy funding, the "Flying Flapjack" was envisioned as a carrier-based fighter that could stay airborne almost at a hover. After 139 hours of flight testing the V-173, the Navy ordered a beefier version, designated



JAY MILLER

The Flying Flapjack, sent back to the kitchen.

XF5U-1, which was the last piston-engine fighter Vought built. It never flew; the Navy canceled its order and transitioned to turbojet-engine fighters.

Vought foundation spokesman Dick Atkins says the organization, a 1996 offshoot of the Vought company's retiree club, plans to restore the V-173 to Smithsonian standards, refurbishing or replacing all fabric, wood, and other parts and structure. "Even the engines will have to be capable of being started by the time we're finished," he says. "We'll essentially roll out a like-new aircraft."

The work is expected to take two years, and the Smithsonian will lend the results for display in the new Frontiers of Flight Museum at Love Field in Dallas, Texas.

—Jay Miller

Build It and They Will Simulate

Environmental Tectonics Corporation of Pennsylvania has developed a multi-axis centrifuge combined with a high-fidelity cockpit simulator, producing technology that does a remarkable job of reproducing gut-straining air combat missions.

Strap into the Authentic Tactical Flight Simulator S-400 gondola, which employs the actual controls of a fighter—in this case an F/A-18 (ETC says it can replicate any modern fighter). The 110-degree field-of-view display provides a wide window on the outside world and cues to peripheral vision, which are crucial to subconsciously interpreting the many sensory inputs that rush at you.

The gondola is spun quickly to a startup rate of 1.2 Gs (the additional .2 load is imperceptible). Once the machine is spinning, the centrifuge adds ("loads") or subtracts ("unloads") Gs in precise responses to the control movements the pilot makes.

Roll left and suck the stick into your gut, and the resulting 7 Gs build and hold. Based on computer modeling of actual aircraft characteristics, ETC's system provides the appropriate visual, auditory, and tactile sensations. The pilot gets direct, accurate feedback on his handling.

In the split-second environment of modern jet combat, experience in knowing how your fighter feels as you crank it around to get a shot saves crucial

time. You don't have to monitor an instrument to know that the hard turn you're in will quickly run out of airspeed—your brain and body act as an internal instrument to inform you that you can endure only so much strain for a given turn. ETC's simulator is spinning and tilting in fractions of a second to produce the realistic ride. However, ETC hasn't worked out all the kinks yet—transitioning from positive to negative Gs, for example.

The device can be linked to other simulators: For instance, you can fly with wingmen and/or against adversaries.

"The cost of training on the ATFS is one-twentieth the cost of inflight training," says ETC spokesman Shahla Siddiqi. The company foresees its simulator saving the U.S. government, its target client, \$2 billion a year.

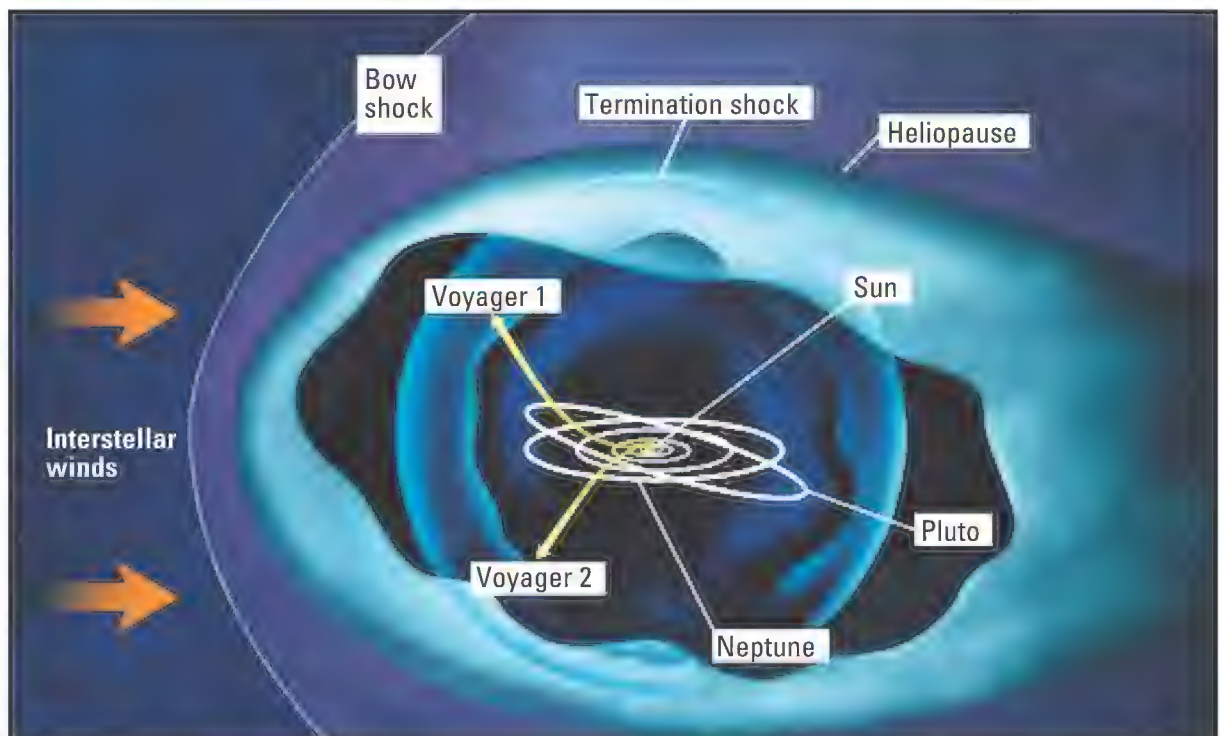
—Braxton Eisel

Is Voyager 1 Shocked?

Voyager 1, which six years ago passed Pioneer 1 to become the most distant man-made object in space, is making history again as it ventures into new territory at the edge of the solar system.

Voyager 1 and its twin, Voyager 2, have been traversing the solar system for nearly 27 years. After completing studies of all the outer planets except Pluto in the late 1980s, they headed out on separate routes for deep space, and each has enough power to continue transmitting until 2020. Scientists have been hoping that Voyager 1, with its six-year lead on Voyager 2, will cross into local interstellar space before power is exhausted (see "Fade to Black," June/July 2001).

In the summer of 2002, instruments on Voyager 1, then some eight billion miles from Earth, began returning readings that showed a significant increase in anomalous cosmic rays—highly charged particles that originated as interstellar atoms. Some mission scientists interpreted these and other indirect measurements as indications that the spacecraft has crossed the "termination shock," the last major threshold on the path to interstellar space. This transition point is where the solar wind and the plasma of the interstellar medium begin to interact, and the solar wind abruptly



The solar system exists inside a heliosphere, a sort of bubble created by the solar wind—streams of electrically charged particles exhaled by the sun. The heliosheath, which scientists believe to be some 14 billion miles from the sun, is at the outer edges of that bubble, where the sun's influence wanes and gives way to the interstellar medium. The termination shock is the boundary area where the solar wind pushes against the plasma of the interstellar medium and slows from supersonic to subsonic speeds.

slows from supersonic to subsonic speeds as it pushes against the interstellar medium. Other Voyager scientists contend their data shows that the spacecraft is merely approaching the shock. Either way, it's a milestone. "This is the final frontier of the solar system," says project scientist Ed Stone of the California Institute of Technology, a

former director of the Jet Propulsion Laboratory in Pasadena.

To get to interstellar space, Voyager must cross the shock and move through the heliosheath, the layer between the termination shock and the heliopause, and finally past the heliopause, the invisible boundary separating the heliosphere from local interstellar space. The heliosphere, heliopause, and termination shock are dynamic, so scientists don't know exactly where the boundaries are. The heliosphere expands and contracts over the long term with the sun's 11-year cycles of activity, and according to the changing balance of pressure. As heliospheric conditions change, so does the shock boundary.

"The termination shock is an aerodynamic boundary that can wash over the spacecraft and recede," says Stamatis Krimigis of Maryland's Johns Hopkins University Applied Physics Laboratory. "It's like standing at the tide line of the ocean. As the tide comes in, it washes over you, and as it goes out, you find yourself in the sand."

Krimigis and colleagues are "absolutely certain" that the spacecraft crossed the shock and entered into the heliosheath in August 2002. The evidence, they say, is in the data collected by the low-energy charged-particle detector, for which Krimigis is principal investigator. "We found a 100-fold increase in the intensity of charged particles, and that they were streaming by the spacecraft mostly along the magnetic field perpendicular to Voyager's path," says Krimigis. "This is

HARDWARE

New Job for an Old Tanker

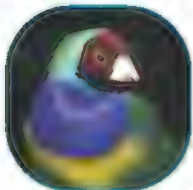
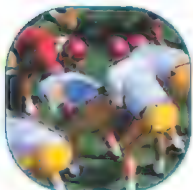
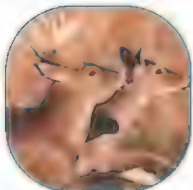
An F/A-22 showers off in the stream of water generated by a sprayer on a KC-135 refueling boom during flight testing of the Raptor in rain and ice conditions. "The Raptor was the first aircraft to use our 'rain and ice' tanker for test," says Sean Hamilton, chief engineer for the Global Reach Combined Test Force at California's Edwards Air Force Base. "A shower head, three and half feet in diameter, was attached to the end of a KC-135's boom. The head pumps water and hot air into the atmosphere, creating a saturated cloud." This system can spray rain and ice onto critical areas like engines and flight control surfaces in clear weather, a condition that is vastly preferable to flying the test aircraft in actual icing conditions. A six-foot-diameter head will soon enable similar testing on civilian aircraft. "Every aircraft can benefit from Edwards' ability to produce rain and ice when there are no clouds and the temperature on the ground is 110 degrees,"

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remarkable, because for 25 years particles from the sun were flowing straight out." They also found other hallmarks of the termination shock including a "a big spike" in the intensity of the radiation, and via an indirect method, a dramatic slowing of the solar wind, "from 700,000 mph to less than 100,000."

In early February 2003, however, the intensity and vector of charged particles indicated that Voyager 1 was suddenly back in the solar wind, a change that, the Krimigis team theorizes, was caused by intense solar activity pushing the heliosheath back out.

Other groups, using data from two other instruments, disagree, theorizing that Voyager 1 experienced only "precursor events." "This is sort of a Lewis and Clark expedition," says Frank McDonald of the University of Maryland, principal investigator of the cosmic ray instrument on Voyager 1, which revealed a significant increase in the numbers of energetic ions and electrons. "We are in the foothills, but we're not there yet. When we get there, we'll know because we will see much higher intensities of anomalous cosmic rays and low-energy particles—much more fireworks, basically."

"There is no consensus, but we are not looking at the same data sets," Krimigis points out. "Our instrument looks at very slow particles and scans the entire sky. The instrument that Frank and his team

are [using] looks at much faster particles and at parts of the sky, not the entire sky."

The controversy would be easily resolved if Voyager 1 could measure the speed of the solar wind, but the plasma detector on the spacecraft no longer functions. Although the detector on Voyager 2 is still operational, most of the scientists don't think they'll have to wait another six years for confirmation one way or the other.

In fact, the heliosphere is now starting to expand again as the sun's pressure returns and it goes to solar minimum. As a result, proffers Stone, "we will likely be surfing this termination shock for the next three or four years." Indeed, the latest data returns are revealing that the anomalous cosmic rays are back, meaning that Voyager 1—whether it's on this side or the other side of the shock—may already be catching the next wave.

—A.J.S. Rayl

Can a Freight Dog Make a Comeback?

John Shearer started his career with Eastern Airlines in 1966, flying a Lockheed Constellation out of New York City's La Guardia Airport. He saw the four-engine Constellation give way to the three-engine Boeing 727, and as chief pilot, with 20,000 hours in command, has since done "just about everything you could do in a 727."

This airshow season, Shearer wants to show the old workhorse in a different color—any color you want, in fact. Shearer will paint your name as sponsor on the fuselage of a 727-200 freighter. His concept combines a flight demonstration with the amenities of a corporate chalet. Add pyrotechnics to the wings and you've got the 727 MainStage.

"We'd put the 727 at the disposal of the airshow producer for VIP air tours," he says. "We could do a recorded show with the local weatherman and a publicity buzz for the show on Wednesday, Thursday, and Friday. We'd generate more smoke than anyone ever dreamed. Then it goes into static display mode on Saturday and Sunday. It would become a focal point because of its size and the external paint job."

Shearer's 15-minute show includes a high-angle climb-out, high-speed passes, and a steep descent to a short-field landing, followed by reversing thrust and backing up to the show center. "We

would not exceed 60 degrees, though in fact you could roll the airplane [360 degrees]," he says. "But we don't want to get into that with the FAA [Federal Aviation Administration]. Maybe the following year." Parked among the concessions and military heavies, 727 MainStage would then operate as a business suite with fresh flowers, an exhibit gallery, and a gourmet galley with private dining.

Some four billion passengers have flown on 727s since they entered service in 1964, but almost the entire U.S. fleet has retired. At the 2002 Fort Lauderdale Air & Sea Show, the final flight of an American Airlines B-727 brought a half-million fans to their feet with a slow, level pass and a dignified steep bank to either side. But the type isn't dead yet. With engine hush kits and various retrofits, the 727-200 series has grown more user-friendly than the original. Hundreds remain in freight service.

Shearer offers a hypothetical example of a consumer electronics company as a sponsor, with a retailer and credit card company as co-sponsors, their logos 34 feet high on the tail, the fuselage, and the three Pratt & Whitney turbofan nacelles. "We would have our own announcer and some instrumental music," he adds. He says that 67 airshows have expressed interest in a combination of a flying display and a benefit concert from Shearer's own blues band. "We're not well known, but wherever we go, we light people up," he says.

—Roger A. Mola

UPDATE

NASA Jets Benched

NASA briefly grounded its four Gulfstream IIs, which are used to train astronauts in space shuttle landing techniques ("Space Shuttle Impersonator," Oct./Nov. 2000), after one shuttle training aircraft shed parts of an engine in flight last December. An astronaut, instructor pilot, and simulation engineer were at 13,000 feet over Florida's Kennedy Space Center when a warning light indicated a problem with a thrust reverser, which the shuttle training aircraft deploys during approach to mimic the shuttle's steep angle of descent. The aircraft made an uneventful landing and the crew saw that the reverser and associated hardware were missing. Divers retrieved the parts from the floor of the Banana River. The agency installed beefier fasteners and returned the fleet to flight in mid-January.



Entrepreneur John Shearer hopes his 727 can come from behind as an airshow star.



Accidental Discovery of Mysterious "Gold Rush" Coin Stuns Experts

World's Rarest U.S. \$20 Gold Proof Found: The San Francisco Mint 1854 Double Eagle Proof!

WASHINGTON, D.C.—A one-of-a-kind U.S. Treasury gold proof coin has been accidentally discovered within the vaults of the Smithsonian Institution. This 1854-S gold Double Eagle \$20 coin was struck by the San Francisco Mint in its first year of operation. The San Francisco Mint was born out of the need for a Western Frontier Mint when, in January of 1848, gold flakes were discovered at Sutter's Mill triggering one of the most important chapters in U.S. History—The California Gold Rush! To the surprise of historians, this single "S" mint Proof coin was individually struck from specially polished minting dies. How this unique Proof Double Eagle made its way across the continent and then into the hands of the Smithsonian Institution is an unsolved mystery to this day.

Today the First Federal Mint announces the public release of the first ever gold Proof commemorative honoring this rarest U.S. Government \$20 gold piece. This 10mil gold Proof has a frosted image against a deep mirror field, creating a breathtaking work of art in gold. This 150th anniversary Mint release honors the legacy of a true historic masterpiece.

The magnificent 10mil gold proof measures a full 39mm diameter to truly showcase the beauty and intricacy of this legendary coin design. The 10mil gold proof is available only through this limited edition, private release from the First Federal Mint at the advance issue price of \$19.95 each.

Fabulous Rarity Valued at \$12 Million.

Only one original proof coin is known to have been struck. Even the foremost rare coin experts were unaware of its existence until it was accidentally found



deep in the vaults of the museum. America's foremost authority on U.S. gold coins, David Akers, has written, "the 1854-S Double Eagle is easily the most significant and desirable branch mint proof coin in existence". With the recent auction sale of one of the three 1933 St. Gaudens Double Eagles for \$7.9 million, senior numismatist Nicholas Bruyer estimates the unique 1854-S Proof Double Eagle would bring at least \$12 million if it ever becomes available at auction.

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2004 marks the 150th anniversary of this historic mint striking. The First Federal Mint is releasing this collectors quality 10mil gold Gem Proof to honor the legend, lore and legacy of the 1854-S Double Eagle!

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While flying in formation on patrol near the Baltic Sea on March 5, 1953, Polish air force pilot Franciszek Jarecki suddenly broke away, diving his fighter from 18,000 feet to below 1,500 in less than 30 seconds to avoid radar detection. Over his radio, panicked Soviet officers demanded that Jarecki return with his top-secret MiG-15bis—or be shot down.

With little more than an hour's worth of fuel, Jarecki, 22, outmaneuvered MiGs sent to intercept him and raced to Bornholm Island, Denmark, which he believed had a large U.S. air base. Finding only farmland, he landed in an empty field and was taken

Franciszek Jarecki's flightsuit is on exhibit at the Steven F. Udvar-Hazy Center at Dulles airport in northern Virginia. The unmarked jacket and pants are displayed near a Mikoyan-Gurevich MiG-15 fighter, the type of aircraft that Jarecki used for his escape. (For information about the MiG-15, visit www.nasm.si.edu/research/aero/aircraft/mig15.htm.)

to a nearby police station to await Danish intelligence officers dispatched from Copenhagen.

Fifty years after his bold escape, Jarecki, now 73 and a U.S. citizen, has donated his flightsuit and other belongings to the National Air and Space Museum for display in a cold war exhibit at the Steven F. Udvar-Hazy Center at Dulles airport in northern Virginia.

Alex Spencer, a Museum specialist in the aeronautics division, says that what really makes the artifacts valuable is Jarecki's international celebrity: He was the third Soviet-bloc pilot to defect during the cold war and the first to escape with a Mikoyan-Gurevich MiG-15bis (the Latin suffix "bis" denotes the second version of the MiG-15). "This guy was here, he was in the country, he had a fascinating story about how he escaped, and he was making the offer," says Spencer. "We just took it. Immediately."

The flightsuit, which had been hanging in Jarecki's Erie, Pennsylvania garage for years, was still in excellent condition when Jarecki donated it in March 2002. No

preservation work needed to be done on the black leather jacket and pants, which, Spencer says, "basically resemble a 1950s version of a motorcycle riding outfit." The suit bears no distinguishing marks, not even a manufacturer's tag, to identify the wearer as a military pilot (if the pilot was shot down, he would want to conceal his identity).

Jarecki also donated newspaper and magazine articles published around the time of his escape, his pilot certificate, his flight school report card, a photograph of him with then-President Dwight D. Eisenhower and future presidents John F. Kennedy and Richard Nixon, and a kids' version of his story. "I was a comic book, you know," he says, laughing.

Jarecki had wanted to be a pilot since he was five. "I was determined," he recalls. When he graduated from high school—already a glider pilot—Jarecki forged his mother's signature to apply to the Polish air force academy. He was one of only 300 students to pass the rigorous admission tests and training. Graduating with two stars for his excellent piloting skills, Jarecki eventually became a decorated lieutenant in the 28th Fighter Squadron, which flew out of Slupsk air force base.

In the West, MiG-15s were already infamous for their speed, maneuverability, dependability, and high rate of combat success. Powered by a Klimov VK-1 turbojet engine and fitted with auxiliary fuel tanks, the MiG-15bis had a maximum speed of 650 mph, a service ceiling of 50,000 feet, and a range of 1,228 miles.

In his years of training in other aircraft, Jarecki had become accustomed to looking at the wings out of the corner of his eye to ensure that the airplane was flying level. On the -15bis, though, he says the wings were so small it was impossible to see them without turning around. "You just have to make yourself very comfortable and have confidence you're flying straight," he says.

When threatened by enemy aircraft, MiG pilots were encouraged to fight, not flee: Aviators were vulnerable to gunfire from behind because MiG-15 cockpits



DANE PENLAND

ARTIFACTS



ERIC LONG

What's a lunchbox doing in the collection of the National Air and Space Museum? In addition to being a well-known example of 20th century American popular culture, it's a small part of the Museum's history. A few of us old-timers remember when the lunchbox was the symbol of the Museum's "Lunchbox Forum," a series of informal weekly noon talks in which either a Museum curator or a guest spoke on some aspect of aerospace history. All Museum staff were welcome, and those of us who attended brought brown-bag lunches and waited until the speaker placed the lunchbox on the table, signifying that the forum was open. Starting around 1967 (when the staff of the National Air and Space Museum kept shop in the Arts and Industries Building) until 1978, we were treated to talks by such notables as John Paul Stapp, Jacqueline Cochran, Grover Loening, and Kurt Stehling. Fortunately, many talks were taped.

The lunchbox, manufactured by the now-defunct American Thermos Products Company of Norwich, Connecticut, in 1960, depicts fanciful scenes of a spaceship and astronauts on a lunar base. It's a little treasure box—wish we had more.

—Frank Winter, curator of rocketry

were not equipped with protective armor plates. Jarecki was particularly worried about enemy rounds depressurizing his cockpit. "Hell, you can go way up, but you're living on the pressure from the system," says Jarecki. "We didn't carry any extra oxygen."

Soon after Jarecki began his career, other officers coerced him to spy on his fellow pilots. "I [was] supposed to write about different pilots: Where do they go? Who do they talk to?" Jarecki was forced to join the Communist party, although he skipped meetings and avoided the officers asking him to watch for defectors. The constant pressure to spy on others made Jarecki think about escaping, although he knew it would be difficult. He had been told that pilots even thinking about defecting were wary of buying foreign maps for fear of arousing suspicion. So Jarecki made no preparations, leaving everything behind. Working in Jarecki's favor was turmoil among the Soviets over Stalin's death that day. When his commanding officer got on the radio and ordered him to return, Jarecki cheekily

replied, "I'm going to get medicine for Papa Stalin."

Though Jarecki had escaped with a top-secret jet, U.S. and British officials initially accused him of being a spy and threatened to deport him back to Poland. "I was really ready to commit some kind of suicide," says Jarecki, remembering the punishments for defecting pilots. "They'd beat the hell out of you. They did terrible things. They'd put needles under your nails." The MiG-15 was returned to Poland on March 22, but Jarecki was not with it. Having checked out his story, Britain had decided to give him asylum, and later, so did the United States, where Congress unanimously passed legislation allowing him to stay.

Throughout the years, Jarecki has received many offers to display his memorabilia, but he always refused, preferring to save the items for his sons. He says he was happy to donate his things to the Museum, however, where such a large audience could see them. Says Jarecki: "I'm glad I kept it all."

—Kelli B. Grant

Location The National Air and Space Museum is located on the National Mall, along Independence Avenue SW, between 4th and 7th Streets, Washington, D.C. The Steven F. Udvar-Hazy Center is at 14390 Air and Space Museum Parkway, Chantilly, Virginia, near Dulles airport.

Hours Both the Museum on the Mall and the Steven F. Udvar-Hazy Center are open from 10 a.m. to 5:30 p.m. every day except December 25. Admission is free.

Dining The Museum's Wright Place Food Court offers items from the menus of McDonald's, Boston Market, and Donatos Pizzeria. Open 10 a.m. to 5 p.m. (Food and drink are not allowed in the Museum's exhibit areas.)

Shopping The Museum offers visitors a three-level, 12,000-square-foot store full of air- and space-theme books, toys, collectibles, and multi-media and educational products. A selection of the Museum's store items can be purchased online at SmithsonianStore.com.

Tours Free docent-led tours highlight the Museum's collection and trace the history of air and space travel. Daily tours depart from the Welcome Center, South Lobby. For information on special tours, call the Tours and Reservations Office at (202) 633-2563.

Lockheed Martin IMAX Theater Fly along with helicopter crews as they carry out sea and mountain rescues. Float alongside the International Space Station. Watch Earth drop beneath you as you ascend in a lighter-than-air balloon. These and other thrills await you at the Lockheed Martin IMAX Theater, where large-format films are projected onto a screen five stories high and audio is broadcast through a six-channel digital surround sound system. For information on schedules and showtimes, call (202) 357-1686 or (202) 357-2700.

To find out more, visit www.nasm.si.edu or call Smithsonian Information at (202) 357-2700; TTY (202) 357-1729.

Our Little Waterworld

For years I'd been talking about flying the English Channel in my open-cockpit, two-seat Mainair Mercury ultralight. For a British pilot, crossing the 20 miles of water that separates us from the rest of the world is a lot like leaving home for the first time: something to be anticipated and feared in equal measure.

Rod Parker, an Australian friend alarmingly enthusiastic about anything with an element of danger, called my bluff: His immediate response to my suggestion was "When do we leave?"

You never really make a conscious decision to do something momentous. You just start doing it. Next thing I knew I was on the phone giving my credit card number to a firm that rented out marine safety equipment. Two days later, the flares, life jackets, and voluminous orange immersion suits arrived, and that Friday night, the weekend weather looked good. Suddenly there were no more excuses.

Rod is a little like an old car—not very good at cold starts but fun once he gets warmed up. When I picked him up at 5 a.m. Saturday, he promptly fell asleep and snored loudly all the way to the airfield.

The first 75-mile leg from our little home strip in Aylesbury to Headcorn Airfield in Kent, jumping-off point for many cross-channel adventures, started at dawn. On the ground, the aircraft looked more like an oversize lawnmower strapped to a big kite than the kind of thing that would transport you to another country. But once aloft in it, you feel you are really flying, as opposed to being glued to an inflight movie in an aluminum tube with wings and big engines.

When we rose into the soft mist, we could barely make out the horses snorting steam in the nearby fields. Ten miles on, fog lay thick over the land. A balloon bobbed serenely beneath us as

we turned back home to wait for the fog to clear, unwilling to risk an engine failure over terrain we couldn't see.

While I paced the field, I had time to consider the dangers of what we were about to do. There is no denying that crossing the channel in a souped-up hang glider powered by an engine usually found on pizza-delivery motor scooters is risky business—people have died trying. If our 46-horsepower Rotax 503 engine fails, as fickle two-stroke engines so often do, and we ditch, and the ultralight doesn't sink instantly, we then have to untangle ourselves from the cat's cradle of wires holding the wing together and hope to avoid getting steamrolled by container ships the size of Switzerland while waiting for rescue. And my 100th hour as a pilot, generally a cause for celebration, would occur mid-crossing, and wasn't that a big fat invitation to fate to drop us in the middle of the world's busiest shipping lane?

When the fog finally cleared, the noon sun was prodding thermals up off the dry brown fields, so we bumped and jerked our way around London to Headcorn. After a farm strip shared only with a few horses, Headcorn, with its skydivers and air traffic, seemed more like Heathrow. The radio controller juggled the circuit traffic, parachutists, and my international flight plan, and said he'd see us tomorrow on the way back. I found that reassuring: There was at least one person who didn't think we were doomed.

While I paced the field, I had time to consider the dangers of what we were about to do. There is no denying that crossing the channel in a souped-up hang glider powered by an engine usually found on pizza-delivery motor scooters is risky business—people have died trying.

As we struggled into our neon-orange immersion suits, we convulsed in laughter at our contortions. Thirty minutes later we were turning over Dover, the sea and sky opening up before us in a horizonless haze of blue. I watched the shoreline slip beneath the front wheel; then there was nothing beneath us but the shimmer of water. My heart beat a little faster, but the engine simply hummed away contentedly, oblivious to the awesome journey it was taking us on.

For Rod, this was a special moment. During the war his father, Noel, had led a squadron of bombers across the channel countless times in conditions





WAYNE SHIPP

we could barely imagine. On his 52nd mission, his Lancaster had been shot up by a German fighter. Ordering his men to bail out, he'd struggled to the back of the aircraft to free the trapped rear gunner when the airplane exploded in midair. Three days later he woke up on the ground, naked, with a broken neck, and no idea of how he survived. He was just 27 years old. The Resistance found him and six months later smuggled him back to England, where he went on to fly—and survive—another 60 missions. Granted, no one was shooting at us, but at least Noel had four engines. We had just one.

As the engine thrummed us toward mid-channel, I glanced at Rod. With the sun slanting sidelong through the haze and behind him the pale blue of a sky that you see only at altitude, I immediately recognized the picture: It was the same as the images you see of mountain climbers on the roof of the world, test pilots on the edge of space, or astronauts backlit by Earth. Man in the extremes, and in this case, nothing holding us up except a few layers of fabric.

No photograph, no matter how vast its size or how vibrant its colors, can ever duplicate the feeling of hanging in that breathtaking hemisphere of blue. At mid-channel, for a few precious minutes, we were suspended in time and space, only the Global Positioning System unit quietly counting away the miles to remind us that we were actually moving and the world was still turning.

Eventually Cap Griz Nez on the French coast floated toward us out of the haze, bomb craters still peppering its surface. As we drifted along the coastline toward the Calais airport, a gleaming line of white Art Deco buildings and green grass being slowly washed gold by the lowering sun, we passed over crumbling German bunkers and beach defenses, still squat and threatening after 50 years. Two winking lights at the end of the runway beckoned us as we glided down onto the asphalt, rolling to a stop right in front of the tower.

We tumbled out of the aircraft and hugged each other. We were alive, we had made it, and the world felt somehow different. France was no longer just “over there,” it was part of “here” too.

On the way back, the world seemed smaller. The water was less intimidating, Headcorn was now a quaint Kent airstrip, and 75 miles was just a short hop.

When we landed at our home strip, the owner appeared. He was opening a bottle of champagne, and the cork ricocheted off the wing. Since then, of course, I've returned to work, driven my car, spent money, and eaten in crowded London restaurants, but I haven't quite descended into the humdrum of daily life on the ground. Something elemental has changed—part of me is now made of the crystal-clear air, the sea, and the sky, and always will be.

—David Holroyd

Only an inventive spirit can imagine things which have never existed before.



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Landing in a Bowl

When a right-angle crosswind hammered his airplane on a Nebraska airstrip one day in 1960, Navy Lieutenant J.R. Conrey started thinking outside the box. He asked Wayne Orchard, then a pilot at the Naval Weapons Evaluation Facility in Albuquerque and Conrey's superior officer, if he had ever thought about a circular runway. Orchard admits he hadn't. Neither had the Pentagon or the Federal Aviation Administration.

Conrey described a bowl-shaped runway, yielding 360 degrees of heading for perpetually upwind takeoffs and landings yet consuming one-third the land of a conventional field. And, to pilots aborting a takeoff or making an emergency landing, the circuitous centerline would offer a crucial benefit: A linear landing strip has a beginning and an end, but a circular runway is infinite.

Adapting formulas for grading highway embankments, Conrey calculated an aircraft's path around a curved, inclined surface. He designed a banked, circular configuration with a 300-foot-wide concentric tier of lanes striped around its 32,000-foot circumference to designate the appropriate path per velocity. The embankment supported speeds from 40 mph at its base to 170 at the top, where the incline was greatest. Flying over the desert east of Phoenix, Conrey noted the round, banked track at the General Motors Automotive Proving Ground, a suitable facsimile for testing. For two years he accumulated sponsors at the Pentagon, secured a patent, and prepared to flight-test his concept.

But in early 1963, while attempting the ultimate straight, short landing, Conrey's A-5 Vigilante struck the ramp of the carrier USS *Independence* and exploded. Posthumously, the momentum of his determination sustained his idea, however, and the Office of Naval Research authorized the project in 1964. Commander Lloyd Smith, a veteran test pilot at NWEF, was approached about conducting the experiment. "I told them it



U.S. NAVY

wasn't really our usual thing," he says. But it sounded doable in theory, and when Navy engineers followed up with a protocol, Smith became project officer.

On March 8, 1964, Smith assembled his task force at the General Motors facility. GM provided a high-speed chase Chevy with movie cameras while an Air Force helicopter hovered with a crash crew. Smith launched from neighboring Williams Air Force Base in a T-28 trainer, circled, then banked in for a landing.

Conrey's theory was immediately vindicated. "The runway performed even better than we expected," Smith says. The equilibrium between gravity and centrifugal effects adhered the aircraft to the embankment, negating destabilizing lateral forces. After two other NWEF pilots took their turns in the T-28, concerns about landing off the mark evaporated. "The physics handled everything," Smith says.

Takeoffs proved surprisingly routine. Accelerating around the flat apron at the bottom, the aircraft drifted smoothly up the embankment to the point of equilibrium. Given the track's two-mile diameter, G-force produced by the centrifugal effects was minimal. "One landing and one takeoff and you were basically comfortable," Smith says.

The project went on hiatus until the following year, when Smith's team again circled the GM track. The lineup included an A-1 Skyraider, a C-54 transport, and an

Lloyd Smith takes a T-28 around the circular track at the GM Proving Ground.

A-4 attack bomber. Now a retired rear admiral, in 1965 Skip Furlong was a lieutenant commander piloting the A-4. The jet's velocity required landing on the steeper pitch of the embankment. "It was somewhat like flying down into a hole," Furlong remembers. But he was soon comfortably testing the runway's optional features. "I could steer the plane entirely with power. Add throttle and climb up the wall, take it off, and sweep down again."

Lloyd Smith set the C-54 down with only inches of daylight between the tip of the outer prop and the upper lip of the embankment. The speeding Skymaster clung to the slope, proving a circular runway could accommodate large commercial craft. The final Navy report assigned the circular runway "a vital place in the future of aviation." But a 1965 *Time* magazine article noted a lack of enthusiasm at the FAA. The expense of constructing and maintaining the precisely banked, perfectly circular configuration, and the complex tunnels underneath to provide access to a central terminal, turned the cost/benefit ratio upside down. The indifference may also have been bureaucratic turf protection—Smith recalls "a strong not-invented-here bias" from Washington agencies. In any case, no circular runway was ever certified.

—Stephen Joiner



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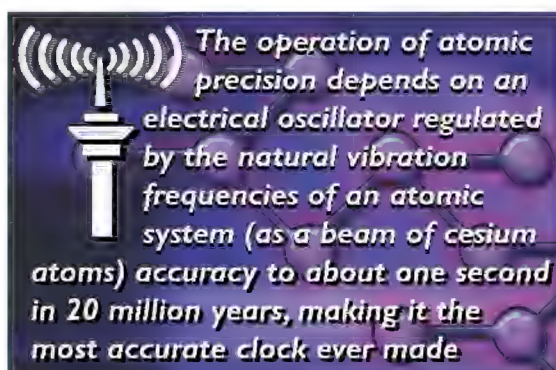
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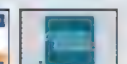
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SO YOU THINK ASTEROIDS HAVE HIT EARTH ONLY ONCE OR TWICE?

CRATER

It's a good thing our lives are so short. Stick around longer, a million years or so, and we'd learn just how ugly nature can be. A half-mile-wide asteroid strikes Earth on average every 500,000 years. Objects the size of an aircraft carrier hit ten times as often, and football-field-size rocks come every 10,000 years or so. An asteroid that size moving at 20 miles a second can punch out a crater more than a mile wide, slamming into Earth with 80 megatons of energy, more than the largest hydrogen bomb ever exploded.

A three-mile-wide object—still much smaller than the one that most likely killed the dinosaurs—delivers more energy at the moment of impact than all our planet's earthquakes, volcanoes, and tsunamis typically release over hundreds of years. Short of the sun going nova, an asteroid impact is the worst natural disaster that can befall us. Don't take comfort in the frequency estimates, either: They are only statistical averages. Any of these things could happen tomorrow.

Every age needs its conception of the apocalypse, whether it's The Flood, The Plague, or The Bomb. The one that has prevailed since the 1980s, when scientists first linked the demise of the dinosaurs to an impact, has been The Asteroid. The odd thing about this one is that it lies so far outside human experience. We have trouble accepting the reality of impact because it hasn't ever happened to people, or so we think. Yet the evidence of cataclysm is all around, if we take the trouble to look. So I head off to Kentucky, like Doubting Thomas, to touch the scars.

Keith Milam is one of those young, energetic scientists whose natural curiosity takes him in half a dozen directions at once. Even while getting his Ph.D. from the University of Tennessee's Planetary Geosciences Institute, he's been part of the large scientific team that planned the current NASA rovers' geologic exploration of Mars (see "Next Stop, Gusev Crater," Dec. 2003/Jan. 2004). Today, though, he's made the two-hour drive from Knoxville to show me around a terrestrial crater, the Middlesboro Impact Structure.

Middlesboro lies at one end of the Cumberland Gap, a narrow notch in the Appalachian mountains through which Daniel Boone led settlers from Tennessee into Kentucky at the close of the 18th century. Though they didn't know it at the time, when they descended from the gap, they were

BY TONY REICHHARDT

Quebec's Manicouagan Lake is the 45-mile-wide circular scar left by an asteroid that hit 200 million years ago.

THINK AGAIN.



GEOLOGICAL SURVEY OF CANADA

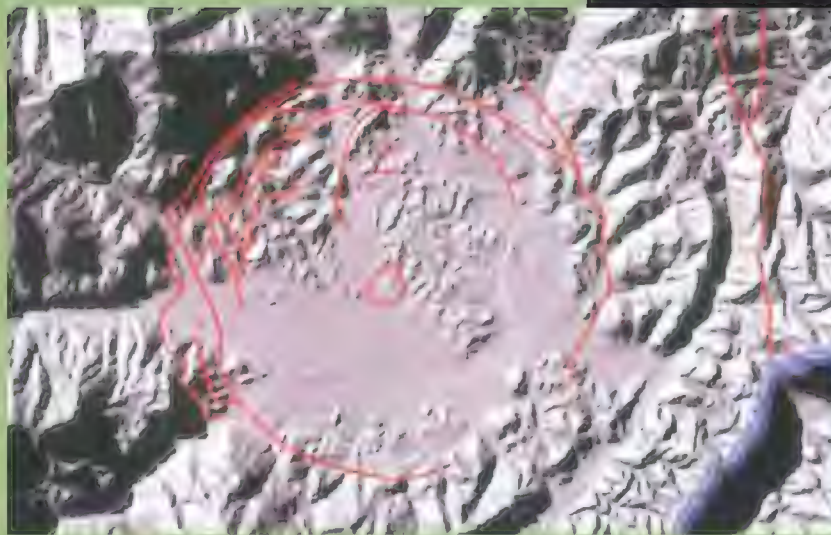
ASC E

Confirmed Impacts in North America

1	Ames	Oklahoma, U.S.A.
2	Avak	Alaska, U.S.A. (not shown)
3	Barringer (Meteor Crater)	Arizona, U.S.A.
4	Beaverhead	Montana, U.S.A.
5	Bee Bluff	Texas, U.S.A.
6	Brent	Ontario, Canada
7	Calvin	Michigan, U.S.A.
8	Carswell	Saskatchewan, Canada
9	Charlevoix	Quebec, Canada
10	Chesapeake Bay	Virginia, U.S.A.
11	Clearwater East	Quebec, Canada
12	Clearwater West	Quebec, Canada
13	Cloud Creek	Wyoming, U.S.A.
14	Couture	Quebec, Canada
15	Crooked Creek	Missouri, U.S.A.
16	Decaturville	Missouri, U.S.A.
17	Deep Bay	Saskatchewan, Canada
18	Des Plaines	Illinois, U.S.A.
19	Eagle Butte	Alberta, Canada
20	Elbow	Saskatchewan, Canada
21	Flynn Creek	Tennessee, U.S.A.
22	Glasford	Illinois, U.S.A.
23	Glover Bluff	Wisconsin, U.S.A.
24	Gow	Saskatchewan, Canada
25	Haughton	Nunavut, Canada (not shown)
26	Haviland	Kansas, U.S.A.
27	Holleford	Ontario, Canada
28	Ile Rouleau	Quebec, Canada
29	Kentland	Indiana, U.S.A.
30	La Moinerie	Quebec, Canada
31	Manicouagan	Quebec, Canada
32	Manson	Iowa, U.S.A.
33	Maple Creek	Saskatchewan, Canada
34	Marquez	Texas, U.S.A.
35	Middlesboro	Kentucky, U.S.A.
36	Mistastin	Newfoundland/Labrador, Canada
37	Montagnais	Nova Scotia, Canada
38	New Quebec	Quebec, Canada
39	Newporte	North Dakota, U.S.A.
40	Nicholson	Northwest Territories, Canada
41	Odessa	Texas, U.S.A.
42	Pilot	Northwest Territories, Canada
43	Presqu'ile	Quebec, Canada
44	Red Wing	North Dakota, U.S.A.
45	Rock Elm	Wisconsin, U.S.A.

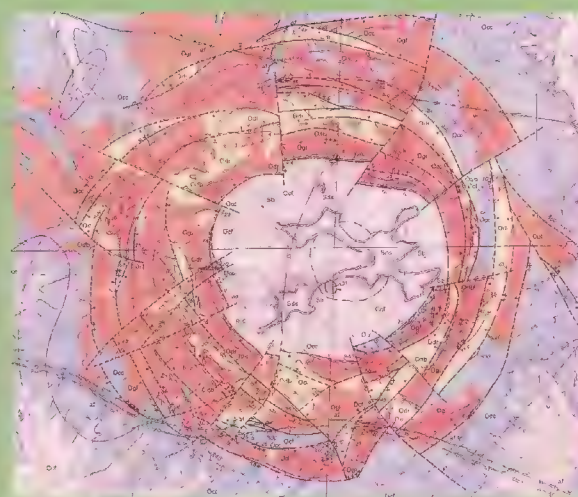
Most of the world's 118 known craters escape notice unless you know what to look for. The peak in Middlesboro, Kentucky (right), jumps out only on an elevation map.

COURTESY MARK F. THOMPSON AND THOMAS N. SPARKS



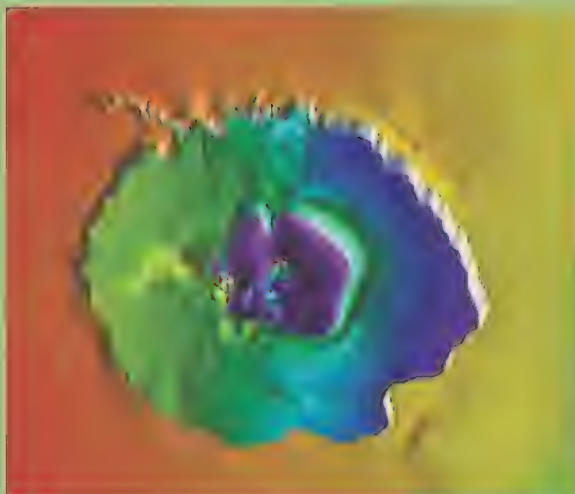
The sixth largest crater on the planet (model, left), a mile-deep hole dug 15 million years ago, is buried under the Choptank Bay and was unknown until the early 1990s.

ORESS CRESSMAN, KENTUCKY GEOLOGICAL SURVEY



Kentucky's Joplin Knob also looks like a crater on a geological map, an island of igneous rock formations belonging to various geologic eras and black lines show faults, or breaks. The piece of lines curving across the bottom is Interstate 69.

C. WYLIE POAG USGS WOODS HOLE SCIENCE CENTER



Some craters masquerade as lakes. New Quebec is the province's largest.

EARTH IMPACT DATABASE PASSC



walking into the eroded remnant of a 3.4-mile-wide crater caused by a collision with a giant space rock some 300 million years ago.

Milam drives me to several sites at the perimeter of the basin, a couple of miles from ground zero, to see traces of the old crater rim, where the rocks are jumbled and wrenched out of their expected positions. One outcrop is behind a fast food joint, another next to a Baptist church. With his finger Milam traces a thin horizontal seam of coal that turns abruptly upward, testimony to a violent upheaval. "See how it jumps here?" he says. Another site off the highway is on private property. Once Milam was there tapping away with his rock hammer when the landowner, a preacher, came down to

see what he was doing. The man listened patiently to the geologist's story, then offered his own Bible-based explanation for the weird rocks.

For many years, that was about as good an explanation as any for geological oddities like Middlesboro. The first systematic mapping of such circular, complex features wasn't made in the United States until the 1920s, when a German-born geologist named Walter Bucher began a survey of formations termed "cryptovolcanic"—the "crypto" implying that some volcano-like trauma had obviously occurred, but that no volcanoes were in sight. Middlesboro didn't catch Bucher's attention, but he noticed circles like Serpent Mound, Ohio, and Wells Creek, Tennessee, both within driving dis-

tance of there. Even though other scientists of the time began to suspect that craters like Ries in Germany and the Pretoria Salt Pan (now called Tswaing) in South Africa had been caused by meteorite hits, Bucher stuck with purely Earthbound interpretations, such as gas explosions from rising blobs of magma that had blistered the surface.

By the 1950s, however, the tide was turning toward extraterrestrial expla-



46	Saint Martin	Manitoba, Canada	50	Steen River	Alberta, Canada	54	Wanapitei	Ontario, Canada
47	Serpent Mound	Ohio, U.S.A.	51	Sudbury	Ontario, Canada	55	Wells Creek	Tennessee, U.S.A.
48	Sierra Madera	Texas, U.S.A.	52	Upheaval Dome	Utah, U.S.A.	56	West Hawk	Manitoba, Canada
49	Slate Islands	Ontario, Canada	53	Viewfield	Saskatchewan, Canada	57	Wetumpka	Alabama, U.S.A.

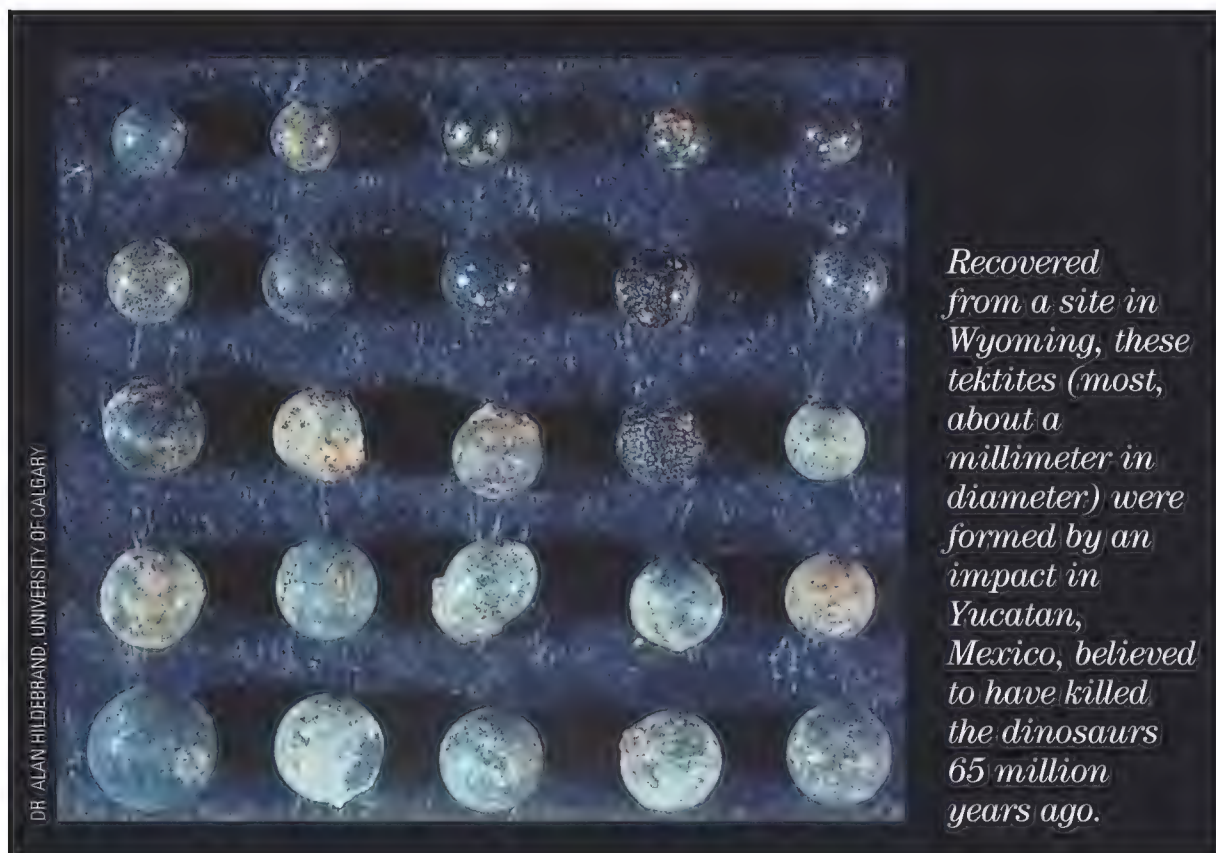
nations. Astronomers had made the connection between lunar craters and meteorite impacts, and in 1963 Eugene Shoemaker of the U.S. Geological Survey finally settled a 50-year argument over the origin of Canyon Diablo in Arizona, a nearly mile-wide bowl carved 50,000 years ago out of the desert floor. Today we know it as Meteor Crater.

A key bit of evidence found at Canyon Diablo is a type of mineral called shocked quartz, which has since become the

most accepted proof for identifying impact craters. Under a microscope, the rock grains are arrayed in a distinctive criss-cross pattern, the lattice structure of the quartz having been knocked off kilter by a sudden, intense blast of pressure. In only two places can you find rocks that have been so profoundly crunched. One is a meteor crater. The other is the bottom of a nuclear test pit.

Middlesboro's status as a confirmed, rather than suspected, crater comes

largely from the discovery of shocked quartz there in the 1960s. Geologists also have found another telltale sign of impact—"shatter cones," caused when the shock wave from a sudden blast moves through rock at supersonic speeds. Milam shows me one. I'm not sure I would be able to tell its subtle striations from all the other ripples you see in rocks. He's always on the lookout for more, and even his seven-year-old, Zac, who's along on our field trip to-



day, is on the hunt. Every so often he holds up a pebble. "Is this a shatter cone?" No, says Milam, smiling.

He's still puzzling out some of the complex evidence himself, trying to reconstruct the details of the impact, which partly depend on what the impactor was made of (there's a big difference between the wallop of a loose iceball and that of a chunk of rock or iron), and how big it might have been (100 to 500 yards across, he guesses). He's starting to think the crater might not be as neatly circular as it appears, that it may be more elongated.

The Middlesboro impact was big enough to form what's called a complex crater. The initial excavation was followed by a rebound of material from the center, creating a central uplift feature, the way a pebble dropped in water splashes up a jet of water. Fractured material then slumped back into the crater, and the outer rim became terraced, unlike the neat bowl you find at the smaller (and fresher) Meteor Crater.

In this case the central uplift feature—ground zero—is on the grounds of the Middlesboro Golf Course, which dates back to 1889 and bills itself as the oldest golf club in the country. On this unseasonably warm Tuesday afternoon in November, the course is mostly empty. I watch a twosome approach the second green, right behind me. A guy who looks like he just stepped

from the Land's End catalog whacks stiffly at a golf ball, which rolls about 10 feet. His next shot dribbles onto the green, and two undistinguished putts later, he picks up his ball, fuming. He looks to be having a bad day.

Of course, bad days are relative. Right next to the first tee (a 273-yard par 4) is an old, weathered block of sandstone that shouldn't be there. By rights this particular rock should be buried 1,300 feet below, with the rest of the Lee Sandstone formation. The asteroid that hit some 300 million years ago yanked it up in a horrifying instant, the central peak uplifted from underneath the now empty bowl.

Out at the perimeter of the original crater, Milam shows me rock beds turned completely upside down, a disorder that can't easily be explained by trivial events like earthquakes. "When I bring professional geologists here who aren't familiar with impacts, they just scratch their heads," he says. In the normal course of geological research, they would never encounter forces like the ones on display here.

Driving north from Middlesboro on Highway 25 late that afternoon, I see that the exposed rock on either side of the road returns to its normal pattern. Stacks of beds, the once-muddy floors of ancient seas, are as flat and regular as the layers of a cake. Order is restored. Leaving this place of past violence, I

see a hand-drawn sign off the highway that says "Prepare to Meet God."

My next stops are Versailles (locally pronounced "ver-SALES") and Jephtha Knob, two other suspected impact structures in Kentucky. They lack shocked quartz or other proof and so are unconfirmed as craters but very likely are anyway.

There's nothing particularly asteroid-attracting about Kentucky. I could easily have chosen neighboring Tennessee or Missouri, each of which has two confirmed craters, or stayed home in Virginia and visited the Chesapeake Bay, which overlies a 35-million-year-old crater. At least 168 impact scars have been identified on Earth, with new ones added to the list each year, and hundreds more suspected. The confirmed ones range from the 200-mile-wide Vredefort crater in South Africa to a piddly little car-size dent in a field near Haviland, Kansas. We only know about that one because it happened so recently, about 1,000 years ago. Most craters smaller than 12 miles in diameter are long gone, eroded flat over geologic time, covered over with sediments, or subducted back into Earth's mantle.

The official list of confirmed craters, called the Earth Impact Database, is kept by geologists at the University of New Brunswick in Canada. Why them? In part because Canada, having large areas of old, exposed crust, has lots of old craters. And in part because Canadian scientists have taken an interest in the subject. Crater hunting is like that, says Richard Grieve, a geoscientist and impact expert with Canada's Natural Resources Department, which used to maintain the database. A dozen craters turned up recently in Scandinavia and Finland, he says, "quite simply because there's been a group of people who've made it their business to go out and find them."

Mark F. Thompson, a geologist and geospatial data analyst with the Kentucky Geological Survey, would like very much to add a new crater to The List. Actually, two craters: Versailles and Jephtha Knob. Today Thompson and I are driving in a soft rain through the rolling bluegrass country outside Lexington, past thoroughbred horse farms and bourbon distilleries, not far

from the small town where Colonel Sanders opened his first chicken joint. I feel like I'm driving over a Howard Johnsons placemat showing the landmarks of Kentucky.

I never would have recognized the mile-wide Versailles structure had Thompson not pointed it out. For one thing, there's no obvious depression. The circular outline of the crater is marked only intermittently by small, deep sinkholes in the limestone terrain. The impact, if one occurred, happened as long as 440 million years ago. Versailles was discovered in 1962 and was originally thought to be a giant sinkhole itself. But later geologic mapping showed faults around the perimeter similar to those seen around impact craters. And the surrounding fields yielded a surprising number of breccias, lumpy conglomerate rocks made of sharp rock fragments fused together. Geologists often find breccias near volcanoes, but there aren't any volcanoes around here.

By the roadside, across a barbed-wire fence, Thompson spies what he thinks might be a breccia. "I wouldn't mind having a piece of that for myself," he says, then decides against it. We haven't gotten permission from the landowner, and he can get a piece when he comes back. He'll need to do more extensive fieldwork if he wants to prove Versailles a crater.

Kentucky's other candidate, Jephtha Knob, is 24 miles away. A three-mile-wide circular formation with a clump of hills sticking up from its center, it was one of the original "cryptovolcanic" structures that puzzled Walter Bucher back in the 1920s. Geologic maps reveal a neatly circular pattern of faults at the perimeter, where Thompson shows me contorted rock beds, evidence of the impact that occurred some 440 million years ago, back when Kentucky was under a warm, Caribbean-like sea. This was long before the dinosaurs, so there were no large animals to look up at the screaming fireball. Just a bunch of shelled creatures whose fossilized corpses I can easily pick out of the crumbly Ordovician-era breccia with my finger.

We head toward the center of the crater, which is on land owned by Cal Schmidt, a genial, soft-voiced man who

looks to be in his early 70s. Schmidt greets us at his home on the edge of a small private lake. He's obviously proud of owning the central uplift feature of a suspected impact crater. When I tell him I spent the day before at Middlesboro, he quickly turns to Thompson and asks, "Is Middlesboro bigger than me?" A joke, but with a hint of concern.

Over lunch, he gives us the recent—at least in geologic terms—history of Jephtha Knob, how his dad bought it for \$26 an acre in 1926, how the bandit Frank James once spent a winter hiding there, how the name comes from an Old Testament warrior. Later, the three of us walk up onto the wooded hill behind the house, where Thompson is on the lookout for breccia deposits that another geologist mapped here many years ago. Shocked quartz is unlikely to turn up at this particular site because it was carbonate rocks, not quartz sandstone, that got smashed in the long-ago impact. Bad luck. But Thompson is studying a core sample, a small amount of material only two inches in diameter but drawn from as deep as 2,000 feet, to find out more about the geology below the surface.

He plans to compare the characteristics of the sample with those of core samples from confirmed impact structures. In doing so, he may discover evidence that will place Jephtha Knob on The List, right there between Jänisjärvi in Russia and Kaalijärvi in Estonia.

Thompson has had to dig a little deeper than geologist Kevin Evans of Southwest Missouri State University in Springfield. Evans recently discovered a 12-mile-wide crater, the Weaubleau-Osceola structure in Missouri, that, if confirmed, would be one of the biggest impact craters in the United States. It's not on The List yet, but that's just a matter of publishing the scientific paper, thinks Evans. He's already found shocked quartz, breccias, the whole bit.

Not to mention a huge bull's eye that popped up on his computer one day.

Weaubleau had been suspected as an impact site because of the tortured rocks in the region, but no crater was obvious. Evans was using a computer graphics program to stitch together four U.S Geological Survey digital im-

All is calm at the Middlesboro, Kentucky golf course today (right), but 300 million years ago at this precise spot a meteorite struck. The geologic evidence of that violent moment appears in the rock nearby, as geologist Keith Milam (below, at left) points out to visitors.



TONY REICHARDT



SAMANTHA BARGER/MIDDLESBORO DAILY NEWS

ages of the area when a thumbnail composite image came up on his screen. "Boom, there was a big circle," he recalls. Nobody had noticed it before because the ring appears broken and happens to straddle the boundaries of the four USGS quadrangles.

Since then Evans has used what promises to become another powerful tool for crater hunting, digital images from the Shuttle Radar Topography Mission, a NASA-Pentagon collaboration that four years ago mapped elevations over the entire globe to an accuracy of about 30 yards, using a radar imager mounted on the space shuttle. When Evans looked at the mission's pictures of Weaubleau-Osceola, another ring only four and a half miles wide appeared inside the circular drainage basin he'd identified from the USGS composite. That, he believes, is the true ground zero.

Remote sensing tools like these might speed up the search for previously unknown craters, particularly ones that are buried or whose surface "expression" is subtle. Other methods have already been applied to that task, including gravity surveys that sometimes show the comparatively loose rubble excavated from a crater as a gravity "low" against a background of solid rock. Using gravity and magnetic maps, Pradeep Talwani of the University of South Carolina last year reported a suspected crater 500 yards under Johnsonville, South Carolina, not far from Interstate 95. If confirmed, it would be the first crater found along the southeast Atlantic coast. There may be oth-

er coastal impact scars, similarly buried by sediments.

Of course, any meteorite that slams into Earth has a 75 percent chance of hitting water. Since the ocean floor is fairly young, geologically speaking, and is continually recycled in deep ocean trenches, carrying the evidence of impact with it, scientists will never know about a lot of the hits Earth has taken. Richard Grieve, the pioneering Canadian impact expert, would love to see the detailed maps of the sea floor that the U.S. and Soviet navies made during the cold war, which undoubtedly show lots of intriguing holes. Despite talk in the 1990s of releasing the maps, he's not holding his breath. There's still "a fair level of paranoia" about declassifying the information, he says.

At least two suspected craters have turned up on the ocean floor. Two years ago, British oil geologists looking at seismic reflection data reported finding a 12-mile-wide multi-ringed impact structure in the North Sea. Much earlier—in the 1960s—a Navy oceanographic research vessel called the *Eltanin* found unusually high levels of the element iridium—which is abundant in meteorites—three miles beneath the Bellingshausen Sea, off Antarctica. Later expeditions to the site found meteorite fragments, and scientists now believe the *Eltanin* site was hit by an object up to a half-mile in diameter a mere 2.1 million years ago.

Dallas Abbott, a geoscientist at Columbia University's Lamont-Doherty Earth Observatory in Palisades, New York, claimed a couple of years ago to

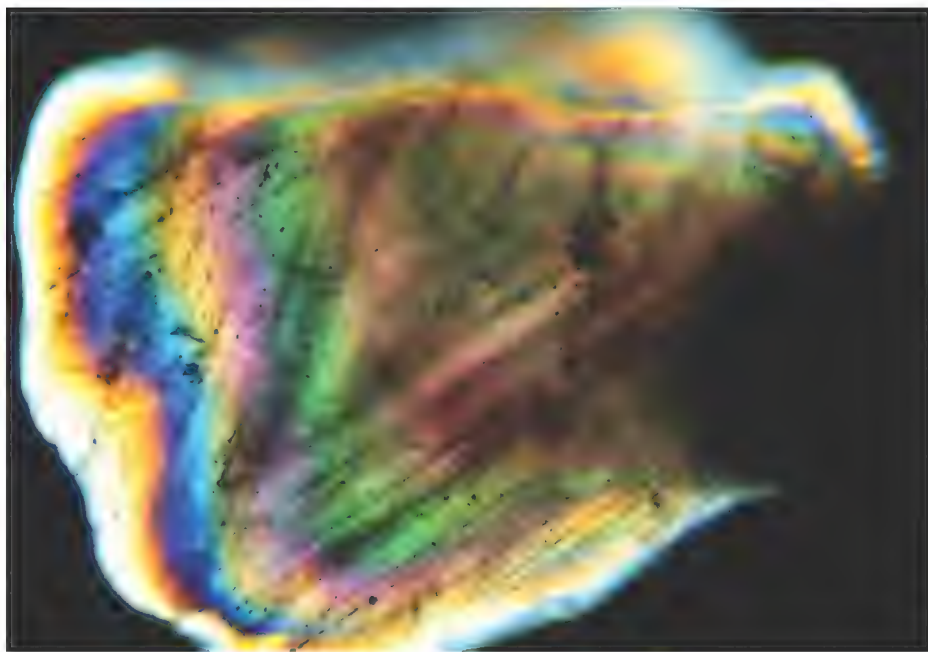
have found a whopping 80-mile-wide crater at the *Eltanin* site. Last year, though, a group of researchers in Germany and the United States disputed her claim in an unusually blunt paper delivered at a meteorite conference in Houston. They argued, based on their extensive research in the area, that Abbott "cannot possibly have found the *Eltanin* impact site."

Undaunted, Abbott made a truly astonishing claim at a geological meeting in Seattle last November. It wasn't so much the size (12 miles) of the crater-like ring she reported seeing in crude satellite-derived maps of the continental shelf off the coast of New Zealand. It was the age—only 500 years. Abbott offered a tantalizing grab bag of supporting evidence. She reported finding tektites in dredges taken near the crater—small beads of glass formed from cooled droplets of liquefied rock, which are also associated with impacts. She noted that other researchers have found tsunami deposits in Australia and New Zealand that some say are too high to have been dumped there by mere earthquake-generated waves. She pointed to curious Maori and aboriginal legends of a mysterious fire in the sky, images that, if based on an actual event, represent the only known account of a large impact.

So far, though, the critics remain unconvinced. An asteroid hit of that magnitude would have regional and perhaps global effects (a rough rule of thumb is that impactors are 1/20th the size of the crater, so this one would have been more than a half-mile wide). There's no clear evidence of such a devastating event circa A.D. 1500.

Other claims of young craters have been less controversial, but the scars are much smaller. The Wabar craters in Saudi Arabia, some of which are buried beneath the sand, were recently dated to 290 years ago, give or take a few decades. The largest is only about 380 feet in diameter. Two Arabic poems, which can be interpreted as referring to a meteor sighting from neighboring Yemen, may even give the exact date: September 1, 1704. And material collected from the proposed (but not yet added to The List) Sirente craters in central Italy dates from about A.D. 412. If those craters turn out to have been

Shocked quartz is the smoking gun of asteroid impacts. Lifted from a hole drilled about 30 miles from the center of the Yucatan crater, this mineral quartz was so severely whacked by a shock wave that its crystalline pattern deformed.



DR. ALAN HILDEBRAND UNIVERSITY OF CALGARY



JOE ORMAN

made by meteorites, the residents of late imperial Rome would have seen explosions more powerful than most humans have ever witnessed.

These signs of recent catastrophe—in fact, the entire catalog of 168 craters—do not help in the least in determining when Earth will be struck again. Planetary scientist Clark Chapman of the Southwest Research Institute in Boulder, Colorado, has estimated the frequency of large and small impacts based on other kinds of data, including ongoing telescope searches for “Earth-crossing” asteroids and military cameras that track fireballs in the sky and let scientists count smaller objects that burn up and never hit the ground. “Earth’s geological record was important a couple of decades ago when we didn’t have much data from a telescopic survey,” says Chapman. “But now, instead of a handful of objects [that orbit in Earth’s neighborhood], we know of literally thousands of them.”

So even though finding new craters is fun, at present it’s more of a scientific trophy hunt than a significant research program. Still, the pace of discovery is picking up as new tools, and new searchers, enter the game. Nearly a third of the craters known today were discovered in the last 15 years.

Few impact structures are as visible as Meteor Crater, a tourist attraction in Arizona (above and right). So it’s hard to believe that Earth has been hit more times than the moon.



D. RODDY NASA/GFRC

Every few months, a new claim crops up. Seneca County, Ohio. Nagano Prefecture, Japan. Grieve often has would-be crater discoverers bring him samples of rock they’re certain contain shocked quartz. Identifying the deformation features can be tricky, but Grieve has seen them so many times it takes him only a few minutes with a microscope to give the visitor a yay or nay. He recalls the time a Chinese scientist brought him a sample. Grieve put it under the microscope. Nope. He handed it back to the researcher, who looked down at the rock, then back up at Grieve. “Chinese craters different,” he said.

Kevin Evans, who expects Weaubleau-Osceola to be added to The List someday, doesn’t claim to be an impact ex-

pert. He says, “I’m just kind of an interloper,” one who normally works on plain old sediment geology. Conducting research in Antarctica had been one of the thrills of Evans’ career, but of the Weaubleau-Osceola discovery he says, “This is the most exciting project I’ve ever been on.”

The tiny town of Vista, Missouri, population “about 80,” is excited about nearby Weaubleau-Osceola too, and is thinking of making it a tourist attraction. Evans enjoys talking to schoolkids about the site; he likes opening their eyes to the reality of asteroid impacts by pointing to the giant hole in their own backyard.

The signs are all around if we take the trouble to look. ➔

Think: the five-and-dime versus the Megalopolis. Your hometown's Fourth of July parade or New Year's Eve at Times Square. The old downtown movie palace or the 14-screen Multiplex. Think: the Lesser Airshow versus the Greater.

Part nostalgia-fest, part county fair, the Lesser Airshows move at a more leisurely pace, offer a variety of fun distractions, and sometimes provide wonderful food from local cooks. And let's face it, the shorter the line ahead of you at the Porta-John, the better.

"Lesser" is a relative term here. Brian Ranch Airport in Llano, California, hosts what it bills as **The World's Smallest Air Show** (this year, May 29 and 30), which brings in about 1,000 people. Others average 5,000, while some may get up to 70,000. Even then, these shows offer audiences much more breathing room than you'll find at blowouts like Oceana, Virginia's Neptune Festival (300,000), California's Marine Corps Air Station Miramar Airshow (500,000), and Oshkosh, Wisconsin's week-long AirVenture (750,000).

Performers see advantages too. "I love the smaller airshows. They often have the coziness of a small party," says Debbie Gary, who flies an aerobatic routine in an SIAI-Marchetti monoplane and has written about aerobatics for *Air & Space/Smithsonian*. "Because there are fewer events in a small town, the airshow always seems like a bigger deal. And since the crowd's excitement is contagious, we catch it and put it into our maneuvers with jazzier, more energized flying."

Walt Pierce of American Barnstormers likes the intimacy of small shows. Pierce, who with a wingwalker flies an act in a Stearman, observes: "The whole event has a personal touch. I like it when we can park our planes on the grass near the fans. During the idle minutes we can walk over and chat with kids and parents. And the comments over the PA system tend to be more [about] the people flying the airplanes rather than about speed and altitude."

AIRSHOW LITE

ALL THE BIG PLEASURES
OF THE LITTLE AIRSHOW.
BY PATRICIA TRENNER

Small airshows have the advantage of flexibility. At the 2001 California International Airshow in Salinas, aerobatics star Sean D. Tucker got around the post-9/11 flying ban by using a non-traditional vehicle (lent by a local animal refuge) for his traditional ribbon cutting act.



TYSON RININGER (4)



Some 5,000 kids attend the Santa Maria, California airshow, where they learn about aviation careers.

*At the Watsonville,
California Fly-In, Bill
Stein builds a smoke cloud
with his Pitts Special.
Allen Silver's parachute
serves as a billboard
during the national
anthem at Salinas (1984)*





At idyllic Grimes Airfield in Bethel, Pennsylvania, vintage aircraft like the Staggerwing at left fly in for the Golden Age Flying Circus Airshow. At the field's museum, all seats are taken (above).

CAROLINE SHEEN (2)

A small show doesn't necessarily mean only small airplanes. California's **Watsonville Fly-In and Airshow** (May 28 to 30), known primarily for a world-class exhibit of antique aircraft, recently hosted a half-dozen Marine Corps AV-8B Harrier vertical-takeoff jets, perhaps the world's loudest aircraft. The **Tucumcari, New Mexico Rotary Club Airshow** (September 29) regularly hosts the Canadian Royal Air Force's Snowbirds, who fly CT-114 Tutor jet trainers. "Years ago the Snowbirds talked us into having our airshow on Wednesday, and we have never looked back," says organizer Bob McClelland. "We can get all the big names because we are the only airshow in the nation on that day." Nearby schools and many businesses close up, and the whole town turns out for the show.

Bring a big appetite to the little show at Marysville, California (below, left). On the other coast, New Jersey's Sussex airport hosts "the biggest little airshow in the world" (below).



TYSON RININGER



Flexibility can give smaller shows a quirky charm. Many, for instance, don't hew to a strict all-aviation program. At Georgia's **Vidalia Onion Festival Airshow** (May 8 and 9), you can jog in the Onion Run, watch the Budweiser Clydesdales, or take in a rodeo. For the kids, there's a carnival. The children who attend Llano's World's Smallest show can enter an art contest, drawing an airplane or anything else at the airport.

The **Blue Ash Airport Days** in Cincinnati (June 12 and 13) offers attendees the chance to enter a 5K race, which is launched by a flyover by one of the show's performers. "We give an airplane ride for the first-place prize," says organizer Cheryl Popp. Audience members can also buy rides: There's a Stearman, a B-25, and, for the less adventurous, a Cessna 172. The show has a classic and antique car show, an



TYSON RININGER

California's Paraiso Vineyards airshow bills a gourmet lunch, wine tasting, and bird's-eye views of the Salinas Valley from a perch in the Santa Lucia foothills.



CAROLINE SHEEN

oldies concert by a local band, and that well-loved aviation tradition, the pancake breakfast.

The homey food at small airshows can be as big a draw as the aircraft. "We have a barbecue cabin with smoked pulled-pork sandwiches, and the Black Forest Restaurant serves German sausage, sauerkraut balls, and cabbage



CAROLINE SHEEN

Oh, go ahead—have barbecue for breakfast, and lobster for lunch. Part of the fun of a small airshow is offbeat pleasures.

pancake breakfast, watch demos of model rockets and aircraft, take glider rides, and get a chance to win prizes: dinners, flowers, haircuts, or a four-by-eight-foot shed.

Small shows aren't afraid of a little irreverence. At the **Old Rhinebeck**

Aerodrome in upstate New York, weekend shows from June to October feature antique and reproduction aircraft in flight, some in kitschy skits with characters like Trudy Truelove, the

balls," Popp says. "Sounds awful—and I'm German!—but they always sell out." At the World's Smallest Airshow, organizer Felice Apodaca notes that a fair number of people show up just for the community association's bake sale.

Other pleasures abound at small shows, like evening dances. In fact, Martinsburg, West Virginia's **Wings of Freedom Airshow** (September 18 and 19) provides free swing-dance lessons before the World War II hangar dance. You can dance to classic rock

at California's **Ramona Air Fair** (June 26 and 27), the country's oldest aerial firefighting base. The show also offers an evening hot-air balloon "glow." (All proceeds benefit the families of aerial firefighters killed in action.)

Smokeyjumpers also play a part in the **Lyon County Fly-In and Airfest** in Fernley, Nevada (May 15 and 16), which opens with a demo jump by the Bureau of Land Management smokejumpers from Boise, Idaho. After that, some 5,000 showgoers can tuck into a

For 34 years, the Flying Circus Aerodrome in Bealeton, Virginia, has steeped visitors in vintage aviation every Sunday from May to October. Buy a Stearman ride, get a snack from Fifi's Airfield Café, or just take in the sights.



CAROLINE SHEEN

Evil Baron of Rhinebeck, and Sir Percy Goodfellow. You can also buy an open-cockpit biplane ride, participate in a vintage-fashion show, and see run-ups of early aircraft engines.

The International Council of Air Shows estimates that up to 18 million North Americans take in an airshow every year. No matter the show size, crowds love the roar of the engines and the smell of the fries. It's just that sometimes, Lesser is more. ✈

BELOW: GILLES AULIARD; RIGHT: TYSON RININGER

Flying a trio of Robinsons, Showcopters calls itself "America's Only Helicopter Airshow Team." This season, the act's first show is California's Watsonville Fly-In.

The Autumn Air-Fest at Fitchburg Airport in Massachusetts celebrates airplanes, carnival rides, music, fireworks, antique cars, and souvlaki and spanakopita.



SUPPORTING CAST

WHAT AIRSHOW AUDIENCES WATCH WHEN THEY'RE NOT WATCHING AIRPLANES.

BY ROGER A. MOLA

Manfred Radius performs at most airshows without an engine—and at some shows without an aircraft.

Performing beautifully controlled, low-level aerobatics set to classical music, Radius flies a ballet of a routine in his model H101 Salto sailplane. An airshow role he began five years ago, though, is a little less graceful.

As Fan Man, Radius dons a clown suit and rides around on a bicycle propelled by an 18-horsepower paraglider engine. Fan Man chases objects, such as a prop rabbit, up and down a ramp past spectators. “I have the throttle in my left hand,” says Radius. “I don’t even have to start pedaling. Just throttle, make sure the bicycle is balanced, straighten out, and it goes up to 30 mph. I spend most of my time braking.” Describing the act as “nutty,” Radius performs it during down times, such as in the morning before flight demonstrations begin and any

time aircraft are grounded due to low cloud ceilings. “When the kids wave back it’s a positive response, and you know you’re entertaining the people,” says Radius. “I’m not doing it for my own pleasure.”

Another non-aerial act with kid appeal is Paul Stender’s Port-O-Jet, an outhouse fitted with a 1,000-horsepower jet engine. “We do a back-and-forth with the [airshow] announcer,” says Stender, the founder of Speed For Hire, Inc., a motorsport entertainment company based in Big Bend, Wisconsin. The announcer will say, “Clear the way—this guy’s really gotta go! He needs to find an outhouse quick!” Stender then runs for the john and slams the door. Fire blasts from the outhouse’s chimney, and when Stender ignites the jet engine, the outhouse sprints down the runway at 40 mph. Cool!

Besides the outhouse act, Stender performs at airshows with his “School

Time” Jet Bus, a hotrod made to look like a schoolbus with flashing lights, a fold-out stop sign, and, naturally, a Westinghouse J-34 jet engine.

Les Shockley prefers Pratt & Whitney J34-48 jet engines. Three of them to be exact. That’s what Shockley uses to shoot the ShockWave Jet Truck, a 7,000-pound Peterbilt semi, down the runway at more than 300 mph. The ShockWave’s engines generate an eye-catching plume of flame and gulp 120 gallons of diesel fuel per run. After the

Some of the acts you may see this airshow season include (clockwise from top): Robosaurus, which subsists on a diet of torched airplanes; Fan Man, clowning around on a propeller-driven bicycle; a hotrod schoolbus powered by a Westinghouse J-34 jet engine; and Ron Sirull and his skydiving miniature dachshund, Brutus.





COURTESY PAUL W. JOHNSON

In an act billed as the "World's Shortest Airport," former U.S. Navy pilot Paul Johnson lands a Piper J-3 Cub on the roof of a 1969 Pontiac Catalina driven by Glynn Newsom.

Peterbilt accelerates for 11 seconds, two parachutes pop out to slow it; if the main chutes fail to deploy, reserves are at the ready.

Unlike some airshow performers, Shockley has no need for a day job during the off-season. He started out racing stock cars in 1960 at age 16 at a drag strip in San Gabriel, California, and had a successful career in funny cars before he switched to jet-powered vehicles, winning the National Jet Car Championship in 1979. With solid airshow bookings, Shockley's business earns enough from the Peterbilt and a second truck, a 1957 twin-jet-engine Chevrolet pickup, to support his wife,

Paul Stender's outhouse proves you can put a jet engine on anything (below). Ventriloquist Wayne Francis and his aviator friend Wingnut entertain airshow audiences with tales of travels to fictional airfields.

three decades, and after admiring the aerobatics of airshow pilots for years, he bought an aerobatic airplane at age 57 and learned how to do all the standard maneuvers. He's now in the process of building the ShockWave Firebird, a scratch-built, twin-engine afterburning jet airplane that he hopes to exhibit at the Oshkosh, Wisconsin fly-in this summer.

Another veteran airshow performer with auto racing roots, Scott Hammack drives a jet-powered dragster that for 3,000 performances was known as Smoke-N-Thunder. Last year, when the U.S. Air Force Reserve became Hammack's exclusive sponsor, the dragster's name was changed to the Air Force Above & Beyond Jet Car. "We still have the Smoke-N-Thunder name, but the new paint is definitely dominated by red, white, and blue," says Hammack. Master Sergeant Bill Braack,

a flight engineer with the 730th Airlift Squadron, is the team's marketer and backup dragster driver.

The Above & Beyond Jet Car is powered by a Westinghouse J-34 engine that was taken from a North American Buckeye T-2A; the car's aluminum and magnesium body weighs 2,300 pounds and is 26 feet long. The dragster thunders through two performances each airshow day, the first with 20-foot blasts of fire and a runway dash approaching 400 mph. In the act's finale, Hammack, from a standing start, races his jet car against anything from a biplane to an F-86 Sabre.

During the airshow season, Hammack and wife Linda are on the road from March or April through November. Linda handles the airshow bookings, drives the tractor trailer that holds the dragster and equipment, waves key signals to Scott, and helps pack the dragster's parachute.

There are plenty of other husband-and-wife acts, including Neal Darnell and his wife Marilyn, who haul their Flash Fire Jet Truck to airshows in a million-dollar bus and stacker trailer, along with a convertible, a golf cart, an all-terrain vehicle, and a Chihuahua named Taco Bell. "These jet vehicles are what I call circus acts, and you need some circus acts to sell tickets at airshows," says Darnell.

And what's a circus without animals, even if the beast is a 40-foot-tall, 60,000-pound metal dinosaur? Mark Hays is the owner of Monster Robots, Inc., and the operator of the fly-by-wire



COURTESY PAUL STENDER; RIGHT: COURTESY RTM ENTERTAINMENT AGENCY

Robosaurus, which can crunch a two-ton airplane in its cavernous maw with up to 24,000 pounds of gripping force, breathe a 20-foot tongue of fire, roar with 6,000 watts of sound, and fold itself into a licensed trailer for transportation across roadways. Robosaurus worked his first airshow in 1991, and over the years he has shaken hands with “Tonight Show” host Jay Leno, starred on a Japanese game show, and been spoofed on “The Simpsons” as Truckasaurus. A Robosaurus toy is planned for this year’s holiday season.

“I’m always inside Robosaurus when it moves,” says Hays, whose ground team members, a director and a special effects operator, transmit video to the cab. “I can operate Robo alone, but the visibility is so limited. I’m strapped into Robo’s head, and the director tells me where my back end is. My feet are on the drive pedals, my fingers are in double-sided microswitches, my shoulders roll the arms. I also have some controls for the fireworks system, the air cannon, and the smoke. It gets pretty warm in there. You eat pretty well at these airshows, and [sweating inside the cab] is my only opportunity to lose weight.”

Brutus the Skydiving Dog eats well but remains under 10 pounds. Brutus, a miniature dachshund, and his human, Ron Sirull, parachute out of an airplane

circling above the airfield at an altitude of 6,000 feet. “When Brutus [who wears custom goggles] is in the jump pouch, his ear is right next to my mouth,” says Sirull. “In freefall for more than 10 seconds it’s very noisy, but in the five seconds when you first leave the airplane it’s very quiet, and I just tell him to keep calm, and he’s fine.” The current Brutus is unrelated to the first, who passed away after a career of 100 freefalls. The new Brutus has logged fewer than 10 jumps.

Though Brutus is an aerial act, airshow organizers hire him and Sirull essentially as a ground attraction. “To the crowd, we’re just a speck anyway,” says Sirull. “After we land, we go down the flightline, and I put my finger under his paw so it looks like he’s waving.” The pair have waved off controversy. “I’ve had a run-in or two with the PETA folks,” says Sirull. When Vandenberg Air Force Base in California scheduled the act, base command heard from a local chapter of People for the Ethical Treatment of Animals. A colonel from Vandenberg’s 30th Space Wing issued the following statement: “Brutus rides comfortably, snugly attached to Mr. Sirull’s chest beneath two independent layers of a custom-made jump pouch. In colder weather, Mr. Sirull adds astronaut-like layers to Brutus’ pouch for extra warmth. Brutus’

wind exposure is minimized by use of a ‘sit-fly’ position to shield Brutus from the wind, and an aft-facing exit to avoid the plane’s forward wind motion.”

Wayne Francis has also built an airshow act around a sidekick: Wingnut, a life-size puppet clad in goggles and leather jacket. Ventriloquist Francis and Wingnut attend up to 20 airshows a year. Their routine is built around Wingnut’s tales of travels to fictional airfields, where he meets mermaids and other creatures.

Francis and Wingnut perform at a number of ballooning meets, and Francis says that the balloon crowd can make for a tough audience. “I’ve gone on right after the first launch in the morning,” he says. “You know what’s funny at 7 a.m.? Absolutely nothing. Thanks for coming!” Still, he sees ground acts like his having a permanent tether to airshows: “When the balloons are off, everyone’s looking at the sky and wondering *What’s next?*” ➔

Les Shockley says that his jet-powered trucks have gotten a great reception from most airshow pilots, who sometimes perform duets with the trucks. Flying a Pitts biplane with a top speed of 250 mph, Jim LeRoy swoops past Shockley’s 1957 twin-jet Chevy, which can scream along at more than 330 mph.

DAVID HAYWARD





MIKE ULLERY

ARKANSAS

Fayetteville AirFest	June 19 & 20
Little Rock AFB Little Rock AFB Air Show	June 5 & 6

CALIFORNIA

Camarillo Camarillo Air Show	Aug. 28 & 29
Chino Planes of Fame Air Show	May 15 & 16
Hemet Hemet Ryan Air Show	June 5
March ARB (Thunderbirds)	Apr. 24 & 25
Marysville Golden West EAA Regional Fly-In	June 18-20
MCAS Miramar MCAS Miramar Air Show (Blue Angels)	Oct. 16 & 17
Moffett Field Air Expo at Moffett Field (Thunderbirds)	May 29 & 30
Point Mugu Point Mugu Air Show	Sept. 10-12
Ramona Ramona Air Fair	June 26 & 27
Redding Redding Air Show (Snowbirds, Thunderbirds)	Oct. 9 & 10
Riverside Riverside Air Show	Mar. 27
Salinas California International Air Show (Blue Angels, Snowbirds)	Oct. 2 & 3
San Diego San Diego Air Show (Thunderbirds)	Apr. 17 & 18
Santa Rosa Wings Over Wine Country	Aug. 21 & 22
South Lake Tahoe South Lake Tahoe Air Fest	Sept. 4
Vandenberg AFB Air & Space Show	Oct. 30 & 31
Watsonville Watsonville Fly-In & Air Show	May 28-30

COLORADO

Colorado Springs In Their Honor Air Show	July 10 & 11
Watkins Rocky Mountain EAA Regional Fly-In	June 26 & 27

DELAWARE

Dover AFB Dover AFB Air Show (Thunderbirds)	May 15 & 16
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Lakeland Sun 'n Fun EAA Fly-In	Apr. 13-19
MacDill AFB AirFest (Blue Angels)	Apr. 3 & 4
NAS Jacksonville NAS Jacksonville Air Show (Blue Angels)	Oct. 30 & 31
NAS Key West NAS Key West Air Show	May 5
NAS Pensacola Blue Angels Homecoming	Nov. 12 & 13
Pensacola Beach Pensacola Beach Air Show	July 9 & 10
Pompano Beach Pompano Beach Air Fair	Oct. 16 & 17
Punta Gorda Florida International Air Show (Thunderbirds)	Mar. 27 & 28
Stuart Stuart Air Show	Nov. 13 & 14
Tyndall AFB Gulf Coast Salute (Blue Angels)	Mar. 27 & 28

GEORGIA

Atlanta DeKalb Good Neighbor Day	June 5
Augusta Boshears Memorial Fly-In	Oct. 16 & 17
Dobbins ARB Dobbins ARB Open House (Snowbirds)	May 12
NAS Atlanta Salute to Veterans (Blue Angels)	May 8 & 9
Vidalia Vidalia Onion Festival Air Show (Snowbirds)	May 8 & 9

HAWAII

Kaneohe Bay MCAS Air Show (Blue Angels)	Oct. 9 & 10
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IDAHO

Hayden Thunder Over the Prairie	June 12 & 13
Twin Falls Air Magic Valley	June 26

ILLINOIS

Chicago Air & Water Show (Blue Angels)	Aug. 21 & 22
Lake in the Hills Lake in the Hills Air Expo	June 19
Peoria Prairie Air Show (Blue Angels)	July 24 & 25
Scott AFB Scott AFB Air Show	Aug. 28 & 29
Springfield Springfield Air Rendezvous	Sept. 11 & 12

MARYLAND

Annapolis US Naval Academy (Blue Angels)	May 26
Andrews AFB Joint Services Open House (Blue Angels, Snowbirds)	May 15 & 16

MASSACHUSETTS

Nantucket Nantucket Air Show (Blue Angels)	Sept. 18 & 19
Westover AFB Great New England Air Show (Thunderbirds)	Aug. 14 & 15

MICHIGAN

Battle Creek Battle Creek Balloon Championships	July 4
Grosse Ile Grosse Ile Air Show and Airport 75th Anniversary	June 19 & 20

Muskegon Muskegon Air Fair (Snowbirds)	July 3 & 4
Traverse City National Cherry Festival (Blue Angels)	July 3 & 4

MISSISSIPPI

Keesler AFB Keesler AFB Air Show	Apr. 24
NAS Meridian NAS Meridian Air Show (Blue Angels)	Apr. 17 & 18

MISSOURI

Cape Girardeau Cape Girardeau Regional Air Festival	July 10 & 11
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Columbia Salute to Veterans Celebration	May 29 & 30
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Joplin Joplin AirFest	June 26 & 27
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Kansas City Kansas City Aviation Expo (Thunderbirds)	July 3 & 4
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Poplar Bluff Poplar Bluff Air Show	May 8
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Springfield Firefall 2004	June 26
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St. Louis Fair Saint Louis	July 2-4
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St. Louis St. Louis County Fair & Air Show (Blue Angels)	Sept. 4-6
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Whiteman AFB Wings Over Whiteman	June 18-20
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Gilmer Texas Yamboree Spring Fly-In	Oct. 9 & 10
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Houston Wings Over Houston (Thunderbirds)	Oct. 16 & 17
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Jasper Jasper Air Show	July 4
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San Antonio Lackland AFB Air Show	Nov. 6 & 7
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Laughlin AFB Air Amistad 2004	Oct. 24
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Midland Fina-CAF Airsho 2004	Oct. 2 & 3
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NAS Kingsville NAS Kingsville Open House (Blue Angels)	May 22 & 23
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La Crosse Deke Slayton AirFest	June 12 & 13
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Manitowoc Manitowoc Air Show	June 5 & 6
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Milwaukee Greater Milwaukee Air & Water Show	Aug. 6-8
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Oshkosh EAA AirVenture	July 27-Aug. 2
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West Bend Southeast Wisconsin AirFest	June 19 & 20
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WYOMING

Cheyenne Cheyenne Air Show (Thunderbirds)	July 21
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JUMP INTO THE AIRSHOW SEASON!

AIR & SPACE/SMITHSONIAN 2004 U.S. AIRSHOW SCHEDULE

Vega Three-One. That was the mission and that was my call sign. It was the fourth night of the war—March 27, 1999. The only game in town was our wave of F-117s, striking targets in the northern half of “FRY”—the Former Republic of Yugoslavia.

I was single-ship, not talking and not squawking. I was post-strike in the most heavily defended area of Serbia, egressing the target area, high-subsonic and medium altitude, when I was hit by a surface-to-air missile. It was extremely violent. The jet was slammed into a left-rolling, negative-7-G tuck. Even though I was strapped in tight, my body was sliding out from underneath the lap belt and I was immobilized in the top of the shoulder straps, with my butt far out of the seat and my head and upper body forward, away from the seat back. My head [was] pinned down under the canopy.

It's about an 18-G kick in the butt when you pull those ejection handles; the preferred position is butt in the seat and your spine straight. I remember reaching for the ejection handles, and I remember thinking calmly, matter-of-factly, “You are in the worst possible position—if you even live through this you may have

NAME: U.S. AIR FORCE OFFICER (name withheld on request)
AIRCRAFT: F-117 NIGHTHAWK
CONFLICT: OPERATION ALLIED FORCE
SHOT DOWN OVER: BUDJANOVCI, SERBIA, WEST OF BELGRADE.

massive lumbar damage and a broken neck.” I remember every fragment of the search and rescue, but not actually reaching the ejection handles and pulling on them. There's no doubt in my mind I had some help with that....

It seemed like it took minutes for the entire ejection sequence, when actually it was 1.4 seconds from pulling the handles to hanging under a fully inflated parachute. The seat was tumbling violently and I was again so calm, extremely calm. So many things went through my mind. I remember imagining standing next to the Serbian SAM operator, having a conversation with him and saying, “Really nice shot, but you're not getting me.” Also, “Nuts!”—you know, in a light, humorous sort of way. And “I may not be able to call my daughter tomorrow on her birthday—isn't that an

inconvenience?... *Why am I still in the seat? Maybe I should pull the emergency release lever [which drops the seat and releases the parachute].*” All of the sudden: *Bam!* The seat kicked me out. I was deployed and hanging onto the parachute. I looked up and my first reaction was “Yes, perfect canopy!” My second reaction was—still, in a light, humorous way—“You got to be kidding me—an orange and white paneled parachute, glowing like a Chinese lantern in the nearly-full-moon night!”

The descent I estimate at around eight minutes. I had a lot to do. It got very, very busy. I took inventory, got my survival equipment. I didn't think to check for injuries. I got out my survival radio and started making mayday calls. I had a basic survival radio—no over-the-horizon capability.

There were numerous airborne assets out there, yet I was not able to get good two-way com until Johnny on the Spot, “FRANK 36,” a KC-135 refueling F-16s in Bosnia-Herzegovina, answered my calls. When I was satisfied I'd made good two-way com with a friendly, I tucked the radio away and got busy with other things.

“I Got Shot Down”

Tales of misery and

Interviews by Phil Scott Illustrations by Harry Whitver

The “hold-up” site I ended up choosing was in a shallow irrigation ditch separating two portions of a large, freshly plowed farm field. I was determined to deny the Serbians the significant exploitation and propaganda potential of having a captured F-117 pilot.

From pulling the handles to the time the helicopters pulled me out was just shy of eight hours. They took me to a base in Bosnia, loaded me on a C-130 to Aviano air base [in Italy]; then I was able to talk to my wife on a [secure] STU-III phone to ensure no compromise of anything related to the event, [including] my and my family’s identities. It was a wonderful and emotional phone call, as you can imagine. My wife had been made aware of the situation. And after that I talked to my daughter and wished her happy birthday. She had just turned 10.

survival.

We took off from North Field, Guam. It was a daylight mission over Nagoya, Japan, to bomb the Mitsubishi aircraft engine factory. We started our bomb run at 20,000 feet, which was the highest we ever flew before. We had just dropped our bombs when I heard over the intercom, "Fighters coming in at 12 o'clock level." A second or two later there was a brilliant flash—a Kawasaki Ki-45 suicide plane tore off our left wing with the number-one engine. We rolled over on our back and went into an inverted flat spin. I was 20 years old and I remember saying out loud, "Mom's going to give me hell for this." I was between the passageway and the right gun blister and I figured I was going to die, so I just relaxed and let myself go.

Somehow I went, bareheaded, through the Plexiglas blister—took the entire blister off with my head and took the gunsight off with my shoulder. The left gunner and the engineer got out, but I didn't see them get out. Nobody else made it out. I heard later from the engineer that the plane blew up before it hit the ground. The parachute was open when I came to. I must have pulled the ripcord unconsciously.

I got down. There could have been about 150 to 200 people—soldiers, police—coming after me. Then the fun started. The first one who got to me hit me with a bamboo pole and sent me rolling. A soldier hit me with a bayonet through my flying suit but missed my body. An officer made him stop and then some soldiers beat me up, broke my collar bone and three ribs. They handcuffed me in front and tied a rope around my arms in back and blindfolded me and took me to a bunker and I got beat up again. Then they took me to a railroad station, sat me on a bunker, and threw stones at me for about an hour.

We got into a 1937 Ford V-8. Two soldiers sat in front and I got into the back seat with a guard on either side of me. The car wouldn't start. I said, "I think you're out of gas," and I got a beating out of that. I learned to keep my mouth shut.

We went into this building—I had to have a soldier on each side of me to hold me up, I was so bruised up and I had all these broken bones and I'd lost a lot of blood—and a guy in front of me asked my name and I told them "William Price," and he asked my rank and I told him "sergeant," and he must have not liked that and he hit me twice. I came to and they took me to Nagoya Castle, and I was in solitary for six days. On the seventh day, a nice Japanese guy came in and sat on the floor. He was a nice guy 'cause he didn't beat me. He said I was going to Tokyo. I said, "What for?" He said, "To be executed."

We took a train to Tokyo, to Camp Omori. It was on a sandbar two blocks wide and a block long, but the camp was half that size. B-29 prisoners weren't very well liked. In Germany, one percent of prisoners died. In the Pacific, 40 percent died as POWs. But of captured B-29 crews, only five percent got back alive.

The camp consisted of 517 POWs, and the majority were regular prisoners. They had a group of special prisoners in one building who got half rations. We were special, special prisoners: We got quarter rations. I went four months, 10 days without a bath, shave, or haircut. All of that was in solitary—that was the rough part. Beatings I could take.

I weighed 104 pounds when I got out of the cell and I weighed 150 normally. We got out August 15 and got put in with the rest of the prisoners. We knew something was going on. We heard rumors that the war was over. A few days later the [U.S.] Navy had carriers off the coast of Japan, and the fighter pilots would take up collections of cigarettes and candy bars and drop those on the camp. Later B-29s would come over and drop platforms with parachutes—food, clothing, and stuff like that. I got my first shave and haircut. On August 29 we were liberated.

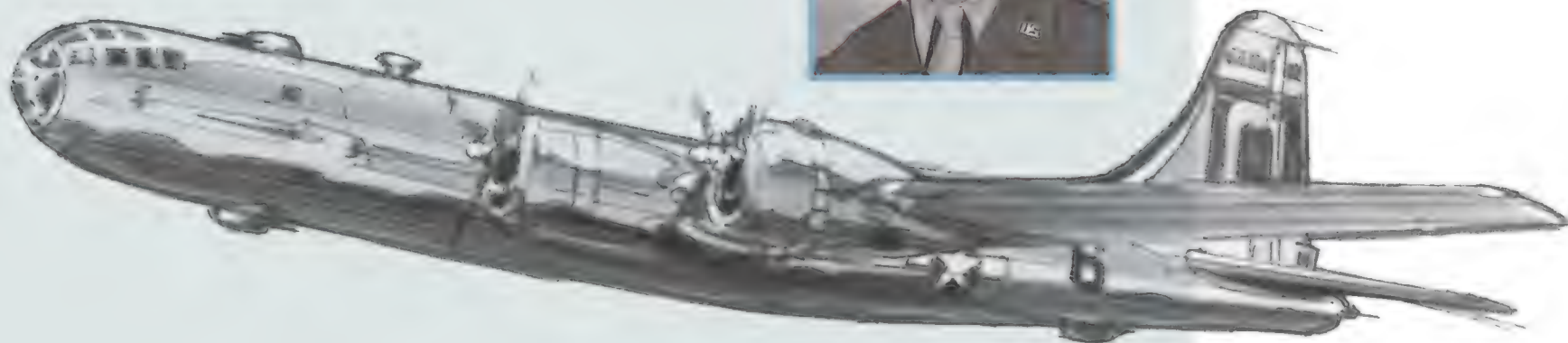
August 29 was another special day—the Japanese had orders to execute all prisoners on August 29.

**NAME: STAFF SERGEANT WILLIAM E. PRICE
(U.S. ARMY)**

AIRCRAFT: B-29 SUPERFORTRESS

CONFLICT: WORLD WAR II

SHOT DOWN OVER: NAGOYA, JAPAN





Our field was northeast of Berlin, near Garz, a little village about five kilometers west from the river Oder. Twenty-seven April [1945].

Russian aircraft were attacking the field, so three or four aircraft took off without any command and just tried to defend our airport. Everywhere you looked there were Russians but no formations; they were loose. Visibility was poor, clouds were all over. I noticed an aircraft coming head on, and I realized it was a Russian Yak 9. They were an excellent aircraft, like a Spitfire, and much lighter than the 190. The 190 had also excellent maneuverability, but the Yak could turn tighter because of the light weight.

At the same time we opened fire at a distance of maybe a mile or two miles, and of course at our speed it was a matter of seconds only. We wanted to bypass each other, but we brushed each other and our two craft disintegrated. Half a minute later I was standing on the ground with my parachute, looking up—it was so fast my brain couldn't fathom what happened. Debris [from both airplanes] was still raining down. I was injured; I lost my four front teeth bailing out. I fell into the tail section of my aircraft and injured my left knee—I tore a ligament.

I was just about half a mile from the fighting front. It was a very dangerous area. One minute later the Russians came from all sides. It was vicious; they tried to rip me from my flightsuit. I'm sure they would have killed me on the spot if [I didn't have] protection from a Russian officer,

NAMES: FELDWEIBEL (FLIGHT SERGEANT)
OSCAR BOESCH (LUFTWAFFE)
AIRCRAFT: FOCKE WULF 190A-8
CONFLICT: WORLD WAR II
SHOT DOWN OVER: GARZ, GERMANY



and I knew why he protected me, because for the next two days I was interrogated 10 times, every time by a different officer. Of course, the interrogation was understandable because they wanted to know where the defense of Berlin was. I didn't get a bite to eat and not a drink of water.

On the third day I was put in a horse-drawn wagon with two wounded [German] infantrymen and a guard and one driver. We must have lost our way because they unloaded us in a little meadow near a village. Just close by was a wooded area like a Christmas tree farm. We expected to be shot. The guard sitting with us was very tired and didn't pay any attention to us; he thought we cannot run away. I had the impression he was falling asleep and I backed away. I ran away—probably 100, 200 feet. It was a run for life or death. Lucky enough they did not search for me.

All over I heard the engines of the tanks and the Russian soldiers preparing for the Battle of Berlin. I knew of the railroad line to Berlin, and I [oriented myself] from the North Star so that I go south. I had to go through [an area along the railroad] about 400 kilometers from

the Russian-occupied frontline [to get home to Austria].

When the war was over on the 8th of May, I was just east of Berlin. In the middle of the night there was a big, big bang—every cannon was fired. It was like World War III. After about a week I got away from the railroad track. I found a bicycle and the pain on my leg was horrendous because I had to pedal. On the way I found some rhubarb and some sugar molasses. I found maybe dirty water. From Leipzig to Munich I helped myself by hanging on with my bicycle on the American convoy trucks and I made that distance in about two days. I could not pedal anymore. The Americans were amused that this dirty man was hanging on and they let me.

I got through all the control points. When we came to Munich I lost my bicycle in the French Zone. The [French] soldiers took it from me. It was almost a fight. The soldiers put a pistol on my chest. I made it home on 18 May. It was my birthday. I was 21. I [had] lost 30 pounds.



NAME: MAJOR EDWARD IZBICKY
(U.S. AIR FORCE)
AIRCRAFT: F-86 SABRE
CONFLICT: KOREAN WAR
SHOT DOWN OVER: YALU RIVER RESERVOIR,
NEAR KWAN-DONG, NORTH KOREA



I was shot down by a MiG-15 in February 1953. We were on air surveillance, flying high CAP [combat air patrol] for fighter-bombers. All the -86s used to patrol up there to make sure nothing was going to shoot down our fighter-bombers. I parachuted into a village and the Korean Home Guard captured me and took care of my wounds. I got shrapnel in my back and left shoulder and a piece in my left wrist, and when I landed in a frozen rice paddy it busted my knees open. It was about 30 degrees below zero.

They turned me over to the Chinese, who had me blindfolded. The Chinese ate a lot of garlic so I could smell it on their faces when they came close to look at me. They hit me and kicked me, and they took me up to an air base in Manchuria,

and there I met the Chinese pilot who said he'd shot me down. He shook my hand and thanked me. [The Chinese] trucked me blindfolded to an interrogation center and interrogated me eight, 10, 12, 15 hours a day for the first 30 days or so. They sentenced me to 100 years in solitary.

They were transferring me a week at a time or so to different parts of North Korea and had me isolated. Every so often I'd get interrogated. I faced three or more firing squads, and I dug my own grave about three times. I just took my time—it kept me away from interrogation. They pointed their rifles at me and they just went *click, click, click*—there were no bullets in them.

After they sentenced me, they put me in a box long enough to stretch my legs out. I had to lie down in it—there wasn't much room. I was in there for a week with no food or water, and then they'd take me out again to interrogate me and I wouldn't submit so they put me in

there again. One guard seemed sympathetic. He sneaked me water every so often.

The war was over in July. They didn't tell me until August. They put me in a truck and drove me to a train station and put me in [a train for] Panmunjom. The last day they released prisoners was August 6th. I got out on August 5th.

My daughter-in-law got on *Google.com* [in 2002] and happened to type my name in. It came up with a list of Russian aces, with their stories on how many people they'd knocked down. At the end of this thing there was this one Russian ace that claimed I was his victim and he explained exactly how it happened in excruciating detail. It wasn't that Chinese. That was a surprise to me.



I was strafing a radar station in southern France—Toulon. Right across the top of the target a damn anti-aircraft shell—20 or 30 millimeters—came right up through the floor and out through the top of the canopy. If it hadn't come up in front of the stick, the family jewels would have been in jeopardy.

I pulled up off the deck at 400 miles per hour maximum and reached an altitude of 800 feet. I pulled a red knob on the panel and the canopy goes off. I hit the trim tab with my left hand and the nose went down. I hit the seatbelt buckle and all the straps came loose and I went flying out of the cockpit. I remember the tail going by—I pulled the D-ring—and going down through the trees. I got bruises and contusions. I hit the ground and rolled over. I landed right in the middle of the guys who shot me down. The damn Germans said, "Ach so," I guess to mean "Look at this." I was captured immediately. August 12, 1944. Number one and three in the flight got through. They didn't see me get out and told [the unit] that I was killed in action.

I went through the interrogation process in Frankfurt, then to Stalag Luft 3. They treated us as officers and gentlemen per the Geneva Convention. In the interrogation they knew more about me than I knew about myself. They had my January '44 Tuskegee Army Airfield graduation picture. The German said, "Lieutenant, is that you?"

I was the fourth black guy in the camp. Three other guys came out of my group, the Tuskegee Airmen. We were like specks of pepper in buttermilk. Many of the prisoners in camp had been there two, three years. They didn't know blacks were trained to fly. Some of

the guys thought I might be a South African. There was still military discipline in the camp. There might have been prejudice, but they never expressed it. We were all in the same bucket.

In the camp, the crew of a B-17 that got shot down arrived, and the word spread that the Red Tails [the Tuskegee Airmen painted the tails of their P-51s red] never lost a bomber while we were in Italy. After that my esteem went up a thousand percent. There was still occasional segregation in U.S. forces on the ground in Italy, but no segregation in the camp. We spread out in different rooms in the barracks, never together. In the end 32 blacks had been captured.

When the Russians started pushing through in January '45, the Germans put us on a road in 20-degree-below weather and we walked 80 kilometers, then they put us in forty-and-eights [railroad freight cars that could hold 40 men or eight horses] and took us to Stalag 7A near Munich, and Patton's army liberated us on April 29, '45.

NAME: LIEUTENANT COLONEL ALEXANDER JEFFERSON (U.S. ARMY)

AIRCRAFT: P-51C MUSTANG

CONFLICT: WORLD WAR II

SHOT DOWN OVER: TOULON, FRANCE



I graduated flight school in February 1970, got into Vietnam April 1, 1970, and got shot down May 2, 1970, the day after the U.S. invaded Cambodia. As a new guy in-country, they put me with an experienced pilot who'd fly in the left seat. Near the end of that day, at around 1600 hours, we took on a load of parts, mail, and four passengers.

We were supposed to fly to a fire support base by the name of Bruiser, right over the Cambodian border. After we got in the air 20 to 25 minutes, a monsoon came in. We had to plunge into the squall. Initially we heard something hit the aircraft. I looked down to my right front and saw what appeared to be red basketballs. It turned out to be radar-controlled .51-caliber fire.

I had been flying the aircraft, but the pilot, Mike Varnado, grabbed the controls immediately, and he's trying to make S-turns to break the lock from the radar-controlled gun. We lost the hydraulics, and the tracers

caught the hydraulic fluid on fire. The back is on fire. The guys, I see them choking and pushing stuff out the doors. I hear "Oh shit." All this hydraulic liquid filled up the chin bubble on the pilot's side, and within a couple of seconds fire is engulfing the whole [port] side. I take the controls while he tries to get away from the fire and puts out "mayday" calls.

As we broke out of the squall, I see a rice paddy 200 or 300 feet below me. I put it into a tight 360-degree turn and brought it down in the center of this paddy. Six people in back of the aircraft are not waiting to get the hell out. The aircraft commander got out of the left door, but mine was jammed. The crew chief, Fred Crowson, helped me crawl out through a window. I looked off to the right and I saw black pajamas [Viet Cong] running toward us. Someone yelled, "Here they come." I pulled out my trusty .38 revolver.

I kept firing at bad guys as I ran toward a dike. I dove over it and within a few seconds somebody came and landed a foot from me: Captain Robert Young [one of the passengers]. Six or seven bad guys were in front of us. I fired, reloaded, and the third time I reloaded, two bad guys with AK-47s took a running jump over the dike and one stuck his barrel in my face, one pointed at Bob's face. A third guy said, "Surrender or die." I dropped that .38 damn quick.

They took us just past the tree line and took our boots off and pulled the laces out and tied us up with the laces. They used our socks as blindfolds. Within a couple of hours they walked us into a POW camp. There turned out to be about a dozen Americans in there. Later that night they brought in Varnado. Mike had been shot in the chest and above the knee cap, and it looked like it had shattered his knee. A week or two later they took Mike away because he had been wounded. We only saw him once again in July and he looked absolutely terrible. Bob Young, he survived for two and a half years. He was a six-foot-tall, 190-pound ranger, a brilliant guy, but he got so sick he dropped down to 75 or 80 pounds. On a Sunday, it was drizzling, and [a guard] unchained me and another guy to pick up the dinner bowls. Somebody yelled, "Go check on Bob." I knelt down and said to him, "We got to get a little food in you." The poor son of a bitch, he died in my arms. Of the last four guys in the helicopter, it turned out that one of them hid in the jungle and made it back to friendly territory in three or four days. The other three were listed as missing in action and have since been declared killed in action.

NAME: LIEUTENANT COLONEL DANIEL MASLOWSKI (U.S. ARMY)

AIRCRAFT: UH-1H HUEY

CONFLICT: VIETNAM WAR

SHOT DOWN OVER: THE PARROT'S BEAK REGION OF CAMBODIA, WEST OF TAY-NINH, VIETNAM





NAME: LIEUTENANT COLONEL THEODORE HARRIS (U.S. AIR FORCE)

AIRCRAFT: RB-29 SUPERFORTRESS

CONFLICT: KOREAN WAR

SHOT DOWN OVER: KHAKUSEN, NORTH KOREA



It was an RB-29, a recce [reconnaissance] version of the B-29, on a nighttime bomb-damage assessment of a bridge strike. The search lights were on us for less than a minute, then we were hit by [MiG-15s].

I don't know if the flames were coming from the engines or the tanks, but there was burning, and burning furiously. I told the crew to bail out. I couldn't stand the fire any longer and I dove out the front hatch and hit my head on the escape hatch and knocked myself out.

When I came to, I was falling. I noticed I could hear a flapping when I put my hand on the risers, and I realized the noise was coming from the skin from my arms and face. I landed in a rice paddy up to my crotch. It took me 20 minutes to work my way out of it. I was exhausted and in shock, of course. I was not aware of any pain at that time. It was 30 minutes after midnight on the fourth of July [1952]. That bit of information flashed through my brain: "Holy cow, it's the fourth of July and I may lose my independence."

I concealed myself in some brush and I passed out or went to sleep. It was after daylight. The next thing that entered my mind was that I had a terrible thirst, because my wounds were weeping liquid so fast. I was well aware of the pain by that time. I went searching for water, and when I got up I heard some North Korean soldiers searching the area. So one of them walked within 10 feet of me and didn't see me.

After they had looked around the area I could hear a truck start and drive away. I started down the hill and in a field I noticed an old woman and young woman. My appearance frightened the old woman and the young woman rushed over to me, and I made some motions that I needed water. She

gave me water out of a bowl and took me into a house where there was a cistern and gave me all the water I could drink. As I was finishing that an old man showed up. He was less than enchanted I was there; all he wanted me to do was get out quick, and I did.

I got on a trail that I thought might take me to another house, but I bumped into an old, old woman. My approach startled her badly. I could tell when she looked at my face and by the way she covered up her mouth. I motioned for water, then she motioned for me to follow her. She took me down the hill, which was practically in a village. She pointed to a building. I passed through the door and saw a guy in a white coat. He looked at me and motioned to me to sit in a chair. He got a mortar and pestle and he threw a lump of white material in and put some water in it and began to mix it up. He came over to me with a thing that looked like a small spatula and began to put that on me.

Then I felt a cold metal pressed in the back of my neck. The old lady had run down and reported my presence. A soldier came there and pointed his AK-47 at me and that was the end of my freedom for the next 14 months.

[Editors' note: Lt. Col. Harris spoke with Phil Scott in July 2003. He died on September 5, 2003.] ➤

Resto

Alpine Air | Junkers Ju 52/3m

Remember the scramble at the end of 1999 to find a New Year's celebration of millennial significance? With very little expense, a Swiss friend of mine outdid all the extravaganzas staged from Times Square to the Great Pyramids at Giza. She—and 67 fellow citizens—watched Zurich's midnight fireworks from the air, as passengers aboard one of the passing century's most significant airplanes, the Junkers Ju 52/3m. Four of the 17-passenger, 1930s-vintage airliners flew over Zurich that night (the only aircraft to do so), thanks to an operation launched 15 years earlier by Kurt Waldmeier, the director of the Swiss air force museum in Dübendorf, who believes life is not worth living unless you accomplish the extraordinary.

In 1981, Waldmeier was presented with an extraordinary opportunity: The Swiss air force retired its three Ju 52s, which for 42 years had hauled equipment, supplies, and Swiss paratroopers-in-training, but in the process had accumulated very few hours; one of them, less than 2,500. "It was like new," says Waldmeier, "and [we] thought we should keep it in the air."

The BMW 132 Hornet engines (so

called because they were built under license from Pratt & Whitney) were "unserviceable," according to Waldmeier, and the military hadn't wanted to pay for an overhaul. The air force museum couldn't afford it either, so Waldmeier announced on Swiss national radio in September 1982 that a Junkers Ju 52 could once again fly passengers if the museum raised enough money to restore it. He gave a call-in telephone number. In a single day, radio listeners pledged 600,000 Swiss francs (about \$450,000). BMW threw in another 500,000. The phone number has since become the reservation line for JU-AIR, a little museum-run airline offering sightseeing flights over the Alps as well as charters. Fundraising and ticket sales were so successful that the museum was able to restore all three aircraft; a fourth—license-built in 1949 by the Spanish manufacturer Construcciones Aeronauticas S.A.

Below: Radical in 1931, the 52 had full-span, segmented flaps, known as a double wing. In place of tailwheels, skids got a better grip on grass runways (and snow).

(CASA)—was donated in 1991 by the Dübendorf airport. In 2002, on Wednesday and Saturday afternoons, JU-AIR flew 12,000 passengers.

Why such an outpouring of enthusiasm for an old Junkers built by Switzerland's big and not always friendly neighbor to the north? Not because of its beauty; look at that snout. Its German crews called it "Tante Ju" partly because its sturdy construction and squat, stocky fuselage suggest an unlovely Teutonic maiden aunt. The nickname, however, also conveyed fondness. According to historians, crews loved the 52 because it was a simple, straightforward aircraft they could count on.

The aircraft was to Europe what the more modern Douglas DC-3 was to the United States in the 1930s and '40s: Anyone who flew commercially in Europe before World War II probably did so on the Junkers. The children of those travelers, having heard their stories of first



airplane flights, are the ones lining up for JU-AIR. Almost 5,000 of the transports were built, and they flew in 30 countries. The 52 carried troops in World War II and was vital in supplying them, a role so well remembered by the Russian government that it refused JU-AIR's request for overflight during an around-the-world attempt in 2000.

One Saturday I toured the JU-AIR maintenance hangar at the Air Force Flight Center in Dübendorf, which is

COURTESY LUFTHANSA/NASM NEG # 78-8038

CAROLINE SHEEN

ration

as clean as an operating room. Chief technician Hanspeter Sennhauser showed me through one of the airplanes while he waited for another to return from its sightseeing tour. Sennhauser, who previously had done maintenance with SwissAir, working mainly on Douglas DC-6s to -10s, said that every engine in the JU-AIR fleet is checked after 105 hours of flight and pulled off for inspection after 1,500 hours. "Some people think *Oh, these are very old aircraft. They could fall down from*

New seats in JU-AIR's 52s (right) are less commodious than the old (below). Opposite: Chief technician Hanspeter Sennhauser smiles through the cockpit's spacious greenhouse windscreen.



NASM NEG # 91-13252

Top: An excellent reason for restoring old airliners with big windows in the cabins. (Note fixed landing gear.) Right: Flight crews are all volunteer.



CAROLINE SHEEN

the sky," he said. "But nothing breaks on these old aircraft. The paint will fade first." Judging from the way the airplanes gleamed, in bright blue and polished aluminum, I very much doubt that the chief technician will let the paint fade either.

Sennhauser and a small crew performed extensive work on the engines—the JU-AIR maintenance shop is now licensed by the Swiss aviation authority to overhaul the BMW 132—including plating the cylinders with channeled chromium that holds oil in the channels, resists corrosion, and adds hun-

dreds of hours to the engine life. The team also replaced fuel tanks, updated cockpit instruments, and refurbished the cabins, using seats donated by SwissAir, in one case from the first DC-9 Douglas manufactured.

The cabins are small but inviting. With a row of seats on either side of the aisle and large rectangular windows, they have the atmosphere, if not the arrangement, of European train compartments. Ear protectors hang at each seat to dim the noise of the BMWs and allow passengers to enjoy the mountain views in relative peace.

After a one-hour flight, the working 52 returned. The aircraft, which flies at

about 75 mph with flaps extended, seemed to approach in slow motion. When it rolled to a stop, Sennhauser placed a ladder at the cabin door. Two smartly uniformed flight attendants descended, then helped the passengers disembark. They stood chatting and laughing as the pilot shook each hand. "That's a good airline, huh?" said Sennhauser. "If you shook hands with everyone on a 747, you'd have two days."

If you define a good airline as one that regards every flight as a celebration, then JU-AIR is indeed top-notch. You can make reservations at its Web site: www.airforcecenter.ch.

—Linda Shiner

RIGHT: JU-AIR/FLIEGER FLAB MUSEUM; BELOW: CAROLINE SHEEN



ERIC LONG

Forty years ago, they figured out
how to reach the moon. Now they
have one word for NASA: "Capsules."

RETRO

During his 34 years at NASA, Ken Szalai had plenty of interesting work, from testing the world's first digital fly-by-wire airplane system in 1972 to running the Dryden Flight Research Center in California in the mid-1990s. But he never got an assignment quite like the one he was handed in March 2003—five years after retiring from the space agency, and less than six weeks after the space shuttle *Columbia* accident. NASA wanted to know if Szalai, by then a private consultant, could lead a handful of veterans from the agency's golden years in a study to determine if the Apollo space capsule, or at least the Apollo design, could be dusted off and turned into a vehicle for future astronauts.

Their answer was yes, in all likelihood. And that opinion, along with more detailed engineering analyses now being conducted by NASA and its contractors, is figuring prominently in the new White House plan to send astronauts to the moon in the next decade. If NASA's Project Constellation, which aims to build a Crew Exploration Vehicle for reaching Earth orbit and beyond, revives the 1960s-style space capsule, at least some of the credit should go to the high-caliber panel of Apollo veterans who gathered for two days last year in Houston.

Theirs was an old-fashioned meeting—no viewgraphs, massive handouts, or even laptops. It was retro space culture at its best. When they were done, Szalai, who at 60 was the youngest one there, thanked each participant personally and paid the group perhaps the ultimate compliment for engineers: "It was easy to see why everything you once worked on was successful."

At the time Szalai got his call from NASA, the agency's space transportation plans were in disarray. The heartbreak of the *Columbia* accident was only part of the problem. Concepts for a next-generation space vehicle, the shuttle's eventual replacement, were becoming more confused each day, at least to outsiders. Even the name of the program kept shifting—Space Launch Initiative, Orbital Space Plane, Reusable Launch Vehicle. No one was more perplexed than Congressman Ralph Hall (D-Tex.) of the House Science Committee, who asked why the agency had canceled the \$3 billion X-38 mini-spaceplane it was building as a lifeboat for the space station, only to replace it with something called the Orbital Space Plane. The Orbital Space Plane, said NASA, would serve as a lifeboat as well as an "up" vehicle for getting astronauts to orbit. Someday, that is. The only thing going up for sure was the price tag: NASA estimated the

Déjà vu? A current Boeing concept looks a lot like the Apollo 11 command module (opposite), now in the Smithsonian.



ROCKETEERS

by James Oberg

space plane would cost \$12 billion, and the cost was climbing.

Against the backdrop of growing Congressional unease, Szalai got a call from managers in NASA's Space Launch Initiative office. It had been several years since they had last looked at the advantages of winged vehicles versus capsules. And now that the agency was talking about a combined up and down vehicle for the space station, the question had once again been raised: Could NASA save money by using old Apollo hardware or blueprints? Was there some technical reason why that design couldn't be adapted for this new Orbital Space Plane?

It wasn't a totally novel idea. Prior to the first shuttle flight, in 1981, a serious proposal had been made to place a leftover Apollo command module inside *Columbia's* cargo bay, docked to the airlock hatch. In an emergency, the astronauts could have entered the module, separated from the shuttle, and returned safely to Earth. Similar ideas kept popping up over the years. Yet NASA had not studied the question in light of its new requirement for a vehicle that was both a lifeboat and a means of getting astronauts to orbit.

"I got the call on a Monday," Szalai recalls. "I was to get the answer to them the following Monday." He spent the first few hours making up a schedule. "I decided immediately on a small team" to keep the discussion manageable. "I didn't want any pushovers—I wanted very strong and opinionated people."

For starters, he knew that Dale Myers, 81, a former deputy head of NASA who had led the North American Rockwell team that built the Apollo command module, was available. From his tenure at NASA, Szalai knew veteran astronaut Vance Brand, 71, who had worked on a five-person command module configuration for rescuing astronauts from the Skylab space station in the 1970s. "And I really wanted John Young," says Szalai. "He's one of the smartest people I know." Young, 72, had traveled twice to the moon in an Apollo capsule, and was still on NASA's payroll in Houston. Aaron Cohen, age 73, was the fifth panel member. Now an engineering professor at Texas A&M, he had headed NASA's program office for the Apollo command and service





The command module's main control panel was state of the art in the 1960s. But an Apollo-derived vehicle built today would likely have all new electronics, displays, and other onboard systems, as well as lighter-weight materials.

modules and had gone on to direct the Johnson Space Center in Houston.

Szalai got them all on the phone—there wasn't time for a formal invitation letter. He was ready to use flag and country to persuade them to cancel their plans for the week and fly to Houston, but he never had to. "Everybody usually has an excuse," he says, "but none of these people did."

Brand, Myers, and Szalai flew to Houston on Wednesday, while Cohen made the two-hour drive from College Station. On Thursday morning, they got a brief welcome from JSC director Jefferson Howell, then went to work in a conference room on the top floor of the center's administration building. "One of the nice conference rooms," says Myers, with carpeting, soft chairs, and a restroom across the hall. "There wasn't anybody there except us chickens," he adds. "There were no other NASA looker-onners." And no time, really, for reminiscing. Yet the feeling of a reunion was inescapable. "I was stuck in a room with all my old buddies," says Brand.

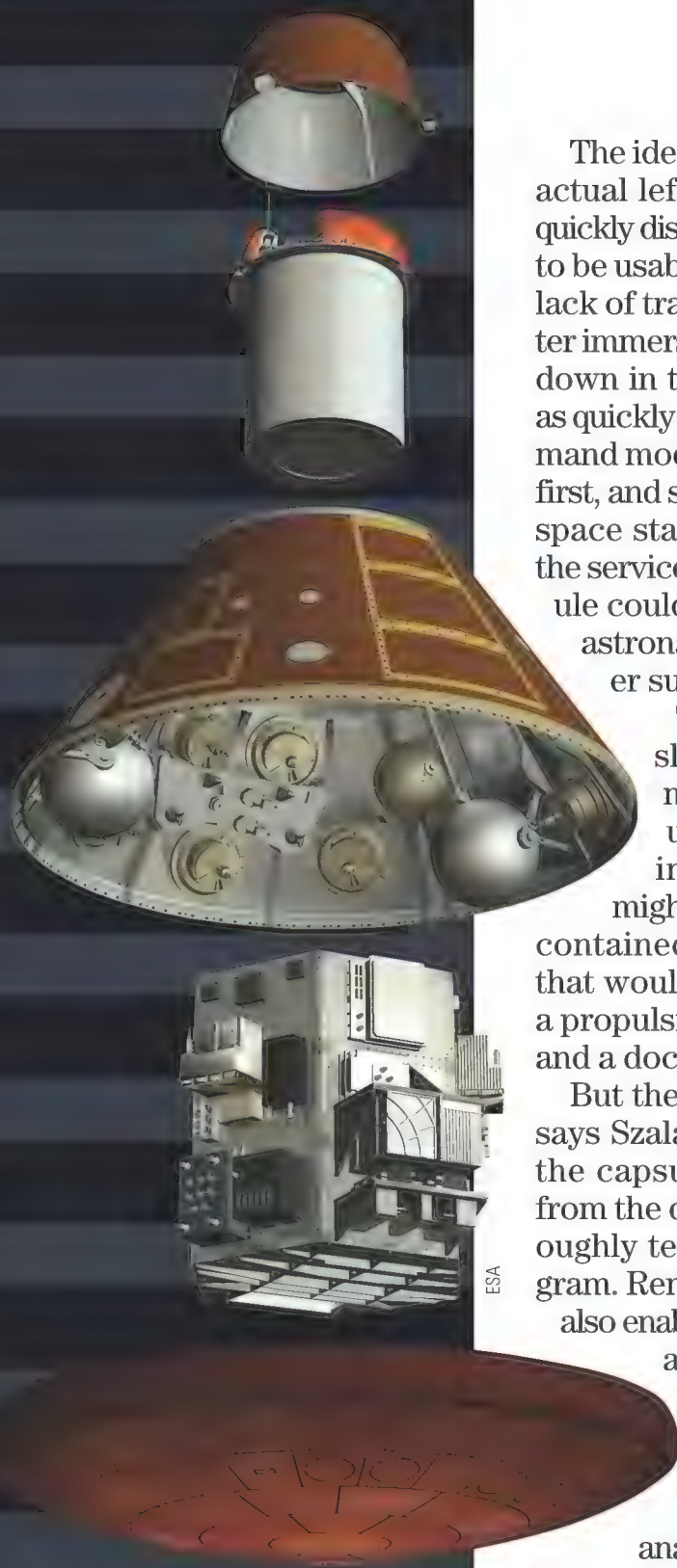
The first task was to assess the Apollo command module as a possible lifeboat, or crew rescue vehicle, for the space station. That remains NASA's most immediate need, since without it the station crew is limited to three people, the seating capacity of the Russian Soyuz craft. The second question was whether an Apollo capsule could serve as the proposed crew transfer vehicle, which was envisioned to launch from Earth on an expendable rocket, visit the space station, and return to Earth, possibly many times.

The team began by ticking off the Apollo design's advantages. In their formal report, the members called the Apollo command and service module—the cramped three-person capsule plus the cylindrical module that provided propulsion and stored critical items like oxygen and fuel—a "highly successful, rugged, and robust system." Compared with a vehicle like the shuttle, it was simple and well understood, which meant reduced risk. And only six weeks after the *Columbia* accident, risk was very much on the team members' minds. "Everybody reacted that you've got to do everything you can to make the thing safe," says Myers.



One question debated by the Apollo veterans (far left, left to right: Aaron Cohen, Dale Myers, Vance Brand, John Young) was whether ocean splashdowns like Apollo 11's (left) still made sense. Coming down on dry land would be better, they concluded.

OPPOSITE: COURTESY MARY SZALAI; LEFT: NASA; TOP: MARK AVINO



Apollo's advantages have been obvious to other space agencies besides NASA. In the 1990s the European Space Agency came up with this concept for an Atmospheric Reentry Demonstrator to return cargo from orbit.

The idea of ransacking museums for actual leftover Apollo hardware was quickly discarded. None of it was thought to be usable, due to age, obsolescence, lack of traceability of the parts, or water immersion—the capsules had come down in the ocean. But the team just as quickly concluded that a rebuilt command module would work well for the first, and simpler, of the two roles—the space station lifeboat. Even without the service module, the command module could accommodate at least four astronauts and enough air and other supplies for a bailout mission.

The vehicle could even grow slightly larger than the 1960s model. “If the CM were scaled up by 5–8%,” said the group in its report, “a crew of 6–7 might be accommodated in a self-contained vehicle.” The only things that would have to be built new were a propulsion module for leaving orbit and a docking adapter for the station.

But there was a limit to scaling up, says Szalai. You didn’t want to make the capsule so big that you strayed from the design that had been so thoroughly tested during the Apollo program. Remaining within that envelope also enabled you to keep the parachute and launch pad escape systems used for the lunar missions.

Whatever data the team members needed for their analysis, they mostly had in their heads. Brand brought along “some stuff about the Skylab rescue mission,” and Cohen had “a few thought-joggers, like Apollo dimensions and weights.” But, recalls Szalai, “the amazing thing is, nobody referred to notes. The things that are most important to you are burned into your brain.”

To keep the stretched Apollo capsule from getting too heavy, the group counted on 40 years of progress in lightweight composite materials. And even though upgrading to a station-compatible cabin air pressure of 15 pounds per square inch, three times Apollo’s pressure, would add weight, that wasn’t considered to be an insurmountable problem.

This was only the basic vessel, though. Inside the roomier command module, practically nothing would remain the

same. “Virtually every system would have to be redesigned, even if it were decided to be replicated,” the group concluded in its report. “Entirely new electronics systems and displays will be required.”

Szalai recalls wondering, “Could you use *any* of the [old] hardware? We spent a few hours, system by system. None of it was supportable; vendors were long out of business. Could we even use the seat? No, we knew how to build better ones now.” One item did survive, though. The Apollo hand controller, used for pilot inputs, could “probably be replicated,” the report stated, although the software that ran it would have to be rewritten from scratch.

“By the end of the first day,” Szalai recalls, “we knew where we were going.” The team disbanded for the evening, some heading to the homes of relatives, some to dinner (and further discussions) at their hotel. The next morning, they turned to Apollo’s landing method, the classic splashdown. Here the group departed from tradition: They agreed that there is an advantage in coming down on dry land: After all, the Russians had been doing this for years with Soyuz capsules (see “Aiming for Arkalyk,” Aug./Sept. 1998). Dry landings would eliminate the expense of rescue ships but would require the engineering of new descent hardware.

Myers, briefing the House subcommittee on space a few months later, called the dry-land landing system “the only major new technology, other than long-duration storage in space,” needed to convert an Apollo command module to a lifeboat. The requirement to make an emergency return anywhere on Earth within 24 hours would add expense and complication, since NASA would need a large number of landing sites to be on standby. But if a service module were attached to provide steering and propulsion, the number of sites would drop dramatically.

Testifying before that same panel, Michael Griffin, a former NASA chief engineer, dismissed worries about landing accuracy. Now with In-Q-Tel of Arlington, Virginia, Griffin told the panel: “Most of the Apollo landing dispersions would have fit easily within the boundaries of Dulles Airport. It

is not necessary to do better than that.”

Szalai's group then turned to the subject of heat protection. The ablative material used on the Apollo heat shield—a phenolic epoxy resin—is no longer manufactured. Fortunately, better materials have come along since, some of which have even been flight-qualified. In fact, the heat shield for an Apollo-derived crew rescue vehicle would have a key advantage over the original: It could be a clip-on, discarded after the fiery return to Earth. And that, said Griffin, made the Apollo-derived rescue vehicle “a system with only one non-reusable component that...can be, almost literally, dirt cheap.”

If the Apollo command module appeared to be a perfectly good lifeboat, all the same advantages applied to the crew transfer, or “up” vehicle. The capsule could easily be perched on an expendable rocket, like a Delta or Atlas, for delivery to orbit. If NASA wanted to return to the moon, a wingless capsule looked even more appealing. Griffin told Congress that a semi-ballistic capsule like Apollo's would be “much better adapted [than winged vehicles] to any requirements to go beyond low Earth orbit.”

As their analysis kept pointing to the advantages of the Apollo capsule, some of the oldtimers found themselves surprised. Coming into the meeting, Szalai thought “there were expectations [within NASA] that the [Orbital Space

Plane] would end up as some type of winged vehicle.” The space veterans he invited were future-oriented, and their instincts were to produce new designs. If anything, he says, “initially the bias in the room was away from the capsule, not for it.” But toward the end of the second day, Szalai voiced his thoughts: “I'm an airplane guy. Why am I recommending a capsule?” Then John Young piped up: “So am I.”

At the Congressional hearing, Myers said, “If all things were equal, I'd choose winged vehicles,” based on their gentler entry and ability to reach a wider range of landing sites. “Unfortunately, they are not known to be equal. And that's why the team recommended a thorough study of the Apollo CM/SM as a CRV/CTV.” The team estimated it could be built within four to six years of NASA's go-ahead.

And so it may be. Even before Szalai's group met, NASA's two main contractors, Boeing and Lockheed Martin, were studying capsules—some rounded like the Soyuz, some cone-shaped like Apollo—as contenders for the crew rescue vehicle. Now that the plans also call for going beyond Earth orbit, the wingless designs may win the day.

“Everybody likes sleek and beautiful,” notes Volker Roth, deputy director of Boeing's Office of Orbital Space Programs in Huntsville, Alabama. “But is that safe and robust?” And former astronaut Michael Coats, who heads

Lockheed Martin's advanced space transportation division, says current astronauts may not be that stuck on wings. He thinks they'll go for whatever is “safe, simple, and soon.”

Not everyone has jumped on the Apollo bandwagon. Last July, at a forum held in Washington, ex-Congressman Robert Walker, now a consultant who often serves on aerospace advisory committees, said that any capsule design would be a problem for Congress. “It becomes, in the minds of people here on Capitol Hill, a huge step backwards,” he says. “It means, essentially, that we're trying to adapt technology that we know how to build.”

Some advocates of reusable spaceplanes don't want to give up on the possibility of building a true single-stage-to-orbit vehicle, which could also have military and civilian passenger applications. Dana Rohrabacher (R-Calif.), who chairs the House subcommittee on space, has been among those pushing hardest for NASA to invest in “next generation” space transportation. But, he told *Space News* last year, “If somebody came in and showed me that a capsule, engineered in the right way, could accomplish all the things we need and was cheaper and would be ready to go quicker, than I would be open-minded to it.”

As for NASA, it's mulling the whole business over. In January, Administrator O'Keefe appointed retired Navy Rear Admiral Craig Steidle, who headed development of the Joint Strike Fighter airplane, as director of the new Office of Exploration Systems at NASA headquarters. For now, Steidle steadfastly refuses to speculate on what Project Constellation's crew exploration vehicle ultimately will look like. And all O'Keefe would say before a Congressional committee in February is that a “spirited argument” is debating whether the vehicle will be reusable.

“We believe a capsule still makes a lot of sense as one element of the [crew exploration vehicle],” says Coats. It could be late summer before Steidle decides whether he agrees. If NASA opts for the capsule, it will come as no surprise to its contractors, nor to the Apollo veterans who came to the same conclusion 40 years ago, the last time the nation set its sights on the moon. ➤



Lockheed Martin has considered both lifting bodies and ballistic capsules for the proposed Crew Exploration Vehicle. The rounded capsule (below) is shown attached to a service module, which provides propulsion.

LOCKHEED MARTIN

BY ROGER WARNER
HOW SILENT U.S. SPYPLANES SKIMMED THE
TREETOPS TO HUNT THE VIET CONG.

NIGHT STAL



In 1966, the U.S. Navy sent a young lieutenant named Leslie J. Horn to South Vietnam to evaluate the use of night-vision devices in combat. Horn, a pilot and physicist, soon found himself in a patrol boat looking for Viet Cong in the canals and waterways of the Mekong Delta in the southern end of the country. With his Starlight scope, a handheld light amplifying device, he could see in the dark, but not through the thick foliage that lined the waterways.

K E R S



Low, slow, and virtually inaudible, Lockheed QT-2s observed activities at night in Vietnam's pancake-flat Mekong Delta region. The QT-2s operated from a U.S. base at Soc Trang (below).

One night, rounding a river bend, Horn had a surprise encounter with an armored junk. A firefight erupted, and Horn began wondering if there wasn't a better way to locate the enemy. What about a spy in the sky, some kind of aircraft that could find the VC without being seen or heard?

"Being a physicist," Horn recalls today, "I figured, *Let's see, noise is energy, so how do you build a plane with low energy?* I started running some equations, and what fell out was a glider." An airframe with a high lift-to-drag ratio wouldn't need much power, so



COURTESY LES HORN

the engine could be smaller and therefore quieter. He sent the Office of Naval Research a detailed proposal for a glider—a sailplane, technically—with a muffled engine and a propeller turning slowly enough to avoid generating a buzz from the blade tips. Crewed by fliers equipped with Starlight scopes, the result would be a night reconnaissance airplane that was very nearly silent.

Americans believe that if we invent gadget X, we can get result Y and change situation Z for the better. So it's no surprise that even before Horn had drawn up his proposal, others had visited the very same turf. The Department of Defense had been asking for new technologies to counter communist infiltration in Vietnam. Before being asked, the big thinkers at Lockheed Missiles & Space had started running analyses and brainstorming.

Lockheed Missiles & Space, based in Sunnyvale, California, had never built an airplane before. The division had produced the Polaris missile, designed for launch by nuclear submarines, and the first generation of spy satellites. But there was a war on, and Sunnyvale's advanced programs group decided to take on the problem of detecting the Viet Cong.

The group began by analyzing the available sensors and their ranges, and then the ranges at which various aircraft could be heard by the enemy. They discovered the problem: The VC could always hear an aircraft coming before the crew on the aircraft could hear or see the VC. What was needed, the Lockheed guys decided, was a super-quiet airborne sensor platform. They studied balloons, sailplanes, and conventional airplanes with mufflers, but found them all lacking. Then Don Galbraith, head of advanced design, suggested a powered sailplane, one with a muffler

and an oversize, slow-turning propeller. Halfway around the world from young Lieutenant Horn, and about half a year earlier, Lockheed Missiles & Space had reached the same conclusion.

Lockheed project manager Stanley Hall, the designer of several sailplanes and known in the national soaring community, was pulled off a satellite project to supervise the quiet airplane. DARPA, the Defense Advanced Research Projects Agency, tossed in a meager \$100,000 to build two proof-of-concept aircraft and sent Les Horn to be its representative at Lockheed. Horn arrived when construction was already under way; he thought he'd died and gone to R&D heaven.

The tiny budget turned out to be an advantage. Because the project was so small, the military and corporate bureaucracies didn't bother with over-

COURTESY LES HORN (2)



Lockheed engineers Stan Hall and Will Curtiss (in cockpit) assemble the QT-2s at Soc Trang (above). Military crews assisted Hall, here installing the vertical fin (left). Tufts of yarn taped to the skin of a prototype revealed airflow around its engine and tail (opposite).

sight. The team set up shop behind a plywood partition in the back of the Lockheed executive hangar at the San Jose airport. Engineers and mechanics came from all over Lockheed, including the famed Skunk Works, where the exotic U-2 and SR-71 spyplanes had been designed and built. But this spyplane was going to be a different: simple, designed to fly low and slow, and built and tested on the cheap.

For the airframe, Hall chose a well-known commercial sailplane, the Schweizer 2-32. His team took an ordinary 100-horsepower Continental O-200 engine and mounted it behind and slightly above the cockpit, so it made a bulge in the top of the airframe, like a camel's hump. The propeller shaft ran above the canopy, outside the airplane, to a vertical pylon attached to the nose. They tested several propellers and chose an eight-foot-diameter model with four wooden blades. To quiet the engine further, the Sunnyvale team lined the inside of the cowl with fiberglass batting and ran the exhaust through a muffler from a 1958 Buick. Instead of using noisy gears, they con-



COURTESY STAN HALL

nected the engine to the propeller shaft with V-belts, similar to fan belts. Les Horn recalls that it was the “only aircraft flying that was powered by rubber bands.” But the engineering and workmanship were first-rate.

The prototype aircraft were designated QT-2: “2” for two-seater, and “QT” for “Quiet Thruster,” officially, though everybody knew it also stood for “on the Q.T.” (on the sly). The first flight was set for August 15, 1967, at an isolated municipal airport in Tracy, California, about 50 miles from San Jose.

Being modified sailplanes, the QTs had a single main wheel mounted in the center of the belly, two tiny wheels under each wingtip to keep the tips from dragging, and a small nosewheel. When the test pilot, Quint Burden, started the engine, he taxied down the runway listing to port until, at around 15 knots (about 17 mph), he had enough speed to level the wings.

After he took off, he circled the field, the big wooden propeller turning at a leisurely 800 rpm, about a third the speed of a normal prop for an engine of that size. “This was a really quiet air-

plane, I tell you,” recalls Hall, who was there for the test flights “We could fly it at 250 feet and barely hear it at all. At 800 feet it was completely silent” to ground observers.

There had been a few studies of techniques for quieting airplanes, but for the most part the Lockheed team had to figure out acoustic stealth for itself. There was ground-level masking noise, to start with—crickets and frogs in the countryside, or the background sounds of a small town late at night, which Lockheed pegged at 50 decibels. Lockheed found the QT’s overall sound level was 70 decibels at 1,000 feet.

Then there was the QT’s acoustic signature, which was different from other aircraft. And it was so close to the threshold of hearing that it was perceived in very different ways. Hall thought it was “the gentle rushing sound of the ocean surf” while Burden, the test pilot, described it as an almost subliminal thub...thub...thub. Others were reminded of tires on a distant highway, the whirring of an electric fan, or a flock of birds overhead. The heart of acoustic stealth, the Lockheed guys

discovered, is a widely observed but imperfectly understood relationship between detecting noise and perceiving and identifying its source. If you didn’t suspect an airplane was above you or notice that a few stars were being blocked and then reappearing, you might not be aware of anything at all—even if a QT-2 were only a couple hundred feet overhead.

Further tests revealed the QT was best flown cautiously, straight and level. A yaw, or turn on the vertical axis, could develop into a larger yaw than expected because the area around the nose pylon was so large it counteracted the stabilizing effect of the vertical tail. A banked turn could lead to a phenomenon called yaw-roll coupling; in a slow roll, which nobody ever tried, once upside down the wings would probably fall off. “It was a very tender aircraft,” says Les Horn, who notes that the original Schweizer has an 8-G rating, while the QT-2, weighed down by an engine and other gear, had a rating of barely 2.4 G.

They needed a long runway for take-off, then the airplanes could slowly

climb to 5,000 feet and cruise at 110 knots. For minimum noise, though, the best speed was down around 70 knots, which was just one knot over the stall speed. In this so-called quiet mode, the craft required only 17 horsepower to stay aloft, according to the tests.

Toward the end of August 1967, the brass arrived at Tracy for a night demonstration. Asked to find the airplane, they peered upward and strained to hear something. Suddenly a bright light appeared directly above them, and the pilot boomed into his mike a single word, "Gotcha!"—amplified, of course, through strategically placed loudspeakers on the ground. Members of the delegation were suitably impressed.

Further modifications were made—portholes in the sides to improve visibility for the backseat observers, a bigger vertical tail to offset the effect of the nose pylon, self-sealing fuel tanks, and military avionics. They received a couple of Starlight Scopes, and training began. Then the QT-2PCs, as the new models were called, were disassembled, put on trailers, and loaded onto C-130s. They were flown to Soc Trang, in the Mekong delta, and the trailers were unloaded and wheeled into a secure hangar, with other trailers encircling them like covered wagons to keep them safe from prying eyes. It was January 1968, and as enemy activity picked up, sandbags were being stacked up around the base.

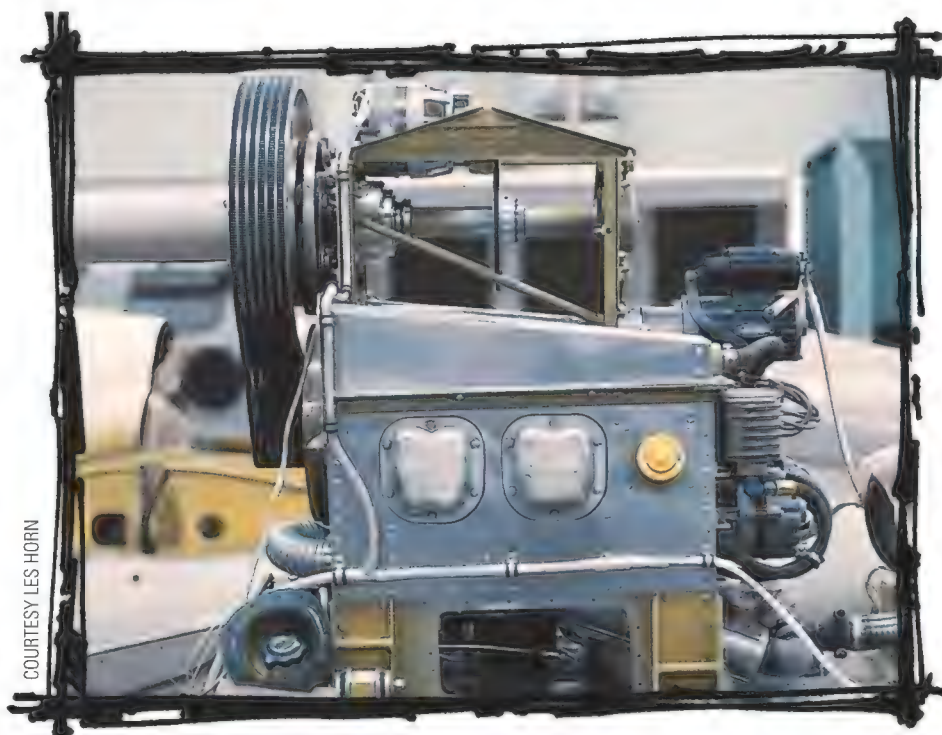
Within a day the funky little airplanes were operational. Under the command of Horn, newly promoted to lieutenant commander, there were briefings in the late afternoon, first flights after sunset, refuelling around midnight, and second flights with a change of pilots until

shortly before dawn. They got in 10 hours of flight time every night.

On January 30, 1968, communist forces launched a countrywide offensive during the Vietnamese new year, or Tet. Soon enemy rockets and mortar shells were landing in Soc Trang. "I was supposed to get a little green card saying I was a noncombatant," recalls a laconic Dale Ross Stith, a Lockheed avionics specialist. "What I actually got was an M-14 and 200 rounds." With Soc Trang under fire, the QT-2s were flown to Vung Tau, which was a little more secure, and the missions continued.

The QT-2 test period in Vietnam in the early months of 1968 was the first use of stealth or low-detection technology in combat and was one of the first

operational deployments of night-vision devices aboard aircraft. Night after night, the QT-2 crews peered into the Viet Cong world without the Viet Cong knowing it. Through their Starlight Scopes, the backseat observers saw—in crude, two-tone green and black—heavily loaded sampans traveling on darkened waterways, truck convoys bumping along on unpaved roads, and



COURTESY LES HORN



COURTESY STAN HALL (2)

Secret tests with troops in California proved the QT-2 worked (above). Six belts linked the engine to the propeller shaft (top). Why it looks funny: They had to put the engine near the center of gravity (right).



thousands of campfires twinkling beneath the jungle canopy. They saw VC sappers—demolition teams—with explosives climbing on a bridge along a major highway and onto ocean-going junks on a southern delta river. The observers radioed reports to the U.S. Military Assistance Command, Vietnam, but at that time MACV, for the most part, couldn't respond. The U.S. military simply didn't have the capability to fight at night.

But the potential was clear enough to James McMillan, science advisor to General William Westmoreland, the commander of U.S. forces in Vietnam. McMillan summoned Les Horn to Saigon and, giving him almost no time to prepare, told him to brief Westmoreland on the project. When Horn walked into the briefing room, "it was like a Time magazine centerfold," he remembers, with not only Westmoreland but the U.S. ambassador, the chairman of the Joint Chiefs of Staff, and others. McMillan introduced Horn as the project officer for what he felt was his most significant science achievement in Vietnam.

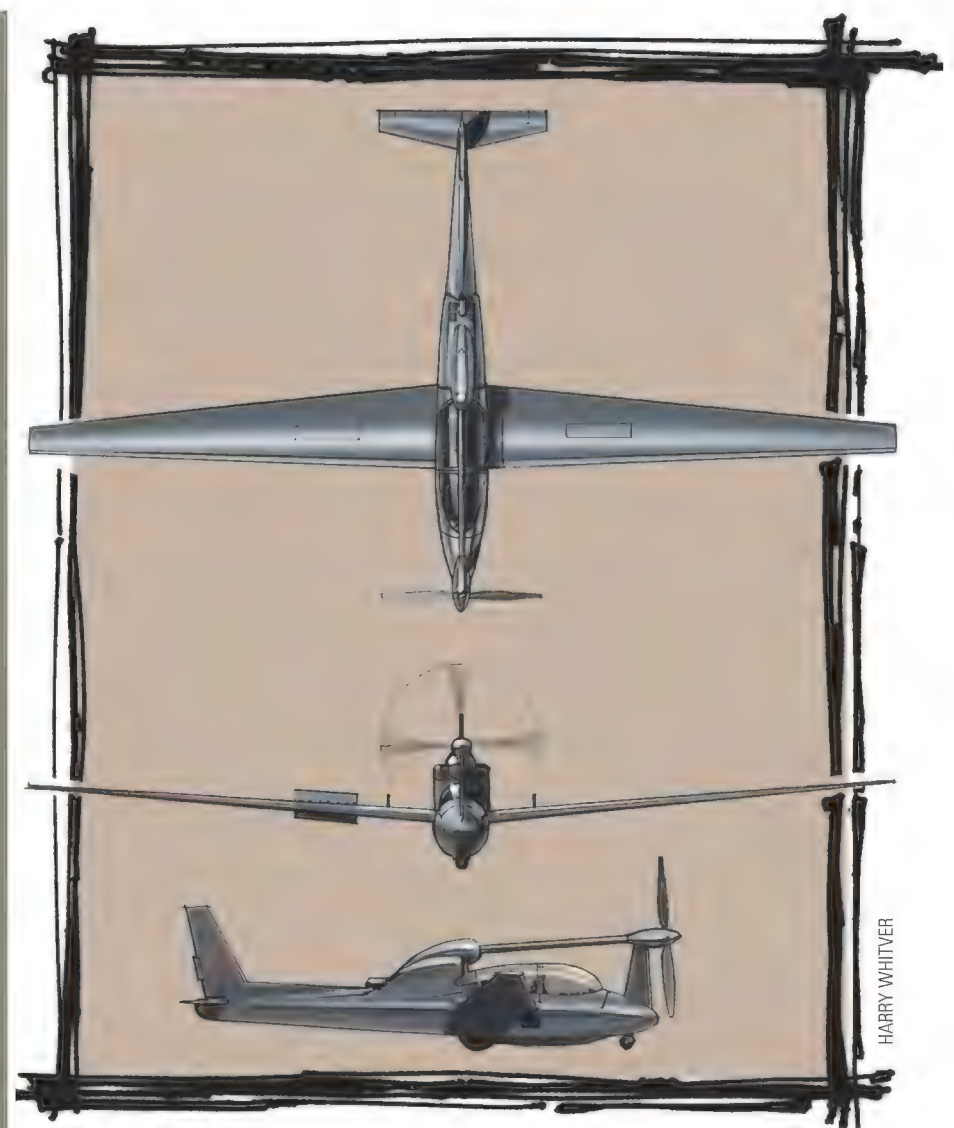
Horn started his briefing, knees shak-

ing, with a grease pencil and a board. Before the briefing was over, Westmoreland was standing with him at the board, sketching surveillance missions that he wanted to run.

The prototype quiet spyplane had passed its test, and now it was time to develop its successor. Back in California, Lockheed had already used its own funds to build what it called the Q-Star. A radiator from a Chevrolet Corvette sat in the nose, and the thing was even more peculiar-looking than the QT-2. The radiator cooled an exceptionally quiet marine Wankel rotary engine. When Curtiss-Wright, which owned the rights to the Wankel engine, decided against manufacturing an air-cooled version for aviation, the Q-Star became a footnote. Lockheed agreed to Stanley Hall's proposal to develop the more conventional aircraft that became the YO-3A. ("Y" indicated pre-production; "O" stood for observation; and the meaning of "A" was unclear, possibly indicating later "B" and "C" models that were hoped for but that never materialized.)

The YO-3A had a 220-horsepower

Continental engine mounted in the nose and an ordinary propeller shaft in the traditional location but driven at low rpm by quiet rubber belts. It had retractable landing gear mounted inboard on the wings. The observer sat in the front under a large bubble canopy and the pilot in the back. The engine compartment had several kinds of acoustic insulation and a muffler mounted on the starboard side of the fuselage. It had a brand-new sensor package, including a laser target designator that was not compatible with anything the military services had at the time. But what really set the YO-3A apart from its predecessor was that, at \$11 million dollars, the program was big enough to trigger every kind of corporate and military oversight, procurement headache, and interservice backstabbing imaginable. "We could have done better," says Stanley Hall, nominally in charge of airframe design, in reality a man whose design decisions were overruled by higher-ranking executives. The YO-3As were not only much heavier than the QT-2s (3,700 pounds versus 2,500 pounds) but also a lot nois-



HARRY WHITVER

ier, with a quiet cruising altitude of 1,500 instead of 800 feet.

With U.S. forces already starting to withdraw from the war, and funding levels falling, only 11 YO-3As were built. Nine were sent to Vietnam in early 1970. They were flown and maintained by the Army in Hue Phu Bai (where a few Marines flew them too) and Long Thanh North, a big base east of Saigon. The little nocturnal spyplanes, nicknamed Yo-Yos, no longer enjoyed an advocate as high up the command ladder as Westmoreland, who was long gone. There was no effort to see what airborne stealth reconnaissance could achieve if given the right resources. And yet the Yo-Yos did their job well.

Much credit goes to the sensor package, which had leapfrogged several generations of technology from the QT-2's primitive night vision scopes. Never mind the laser target designator, which didn't work reliably and was seldom used. Protruding from the fuselage beneath the front seat was an ocular, or eyeball. It was like a periscope but controlled by a joystick, and gimbaled, so that the horizon always looked horizontal in the viewer. Equipped with a light amplifier for night vision, along with an infrared viewer that sensed heat, it provided a view as clear as daytime of the nighttime scene below. The infrared viewer moved in tandem with an infrared illuminator, a kind of searchlight mounted in the belly, aft of the other optics.

Mark Kizaric was a YO-3A observer. A few months out of high school and a self-described pimple-faced kid, he became adept at using the ocular and manipulating the joystick. "After a while you'd get in a zone where you didn't even think of yourself as being up in an aircraft," he recalls. "You kinda lost contact with the real world. It was more like a video game. You're just, you know, going along, you're acquiring targets, noting positions, calling in artillery.

"Most of the time we worked with artillery," says Kizaric, who is now an engineer in Wisconsin. "One especially strong memory is of a very large sampan moving down a river, 30 to 40 feet in length and riding very low in the water at about three or four o'clock in the morning where nobody's supposed to



With radio antennas atop the wings (above), a completely equipped QT-2 sets out over the water highways of the Mekong (right) on a mission that could last more than six hours.

be. We directed artillery fire, and though I'll acknowledge a level of skill on my part, [there was] also an awful lot of luck. I happened to get a direct artillery hit. The sampan had to be loaded from stem to stern with ammunition, because there was a blinding flash that, even outside the ocular, lit up the whole night sky. I lifted my head away and there was this brilliant orange flash. A few seconds later I put my eye back in the ocular and the sampan had literally vanished."

On other nights and missions, the Yo-Yos worked with the helicopter gunships of the 1st Air Cavalry. "We would go well ahead of the choppers and acquire the targets, because we were silent," says Kizaric. "We would find, you know, people sitting around campfires, hot truck exhaust, something like that. We could literally see, in some cases, people moving around on the ground. We would note the position, call in the Cobra gunships, and lock onto the target with our ocular and illuminate the target. When people on the ground heard the choppers come in, all the fires go out and they start



COURTESY LES HORN (2)

scrambling. But it was too late then. We had them on the IRI—the infrared illuminator. The gunships had a screen that could also pick up the infrared illuminator, and so they would home in and open fire.

"[The YO-3] was a wonderful aircraft, when it worked," Kizaric says. Unfortunately, the Yo-Yos didn't always work. Fuel management glitches led to a few crash landings; one unexplained crash



COURTESY STAN HALL



COURTESY DALE STITH

Heavy vehicles block the QT-2 hangar entrance at Soc Trang to hide the aircraft and protect them from frequent mortar shellings (above). The follow-on YO-3 was bigger, heavier, more powerful—and less weird-looking (left).

at night, just to see if they could get away with it. They did.

They left behind some minor folklore: captured VC who wondered how U.S. artillery had tracked them in the dark, and U.S. soldiers who thought they'd

seen ghosts when a silent shadow appeared directly overhead.

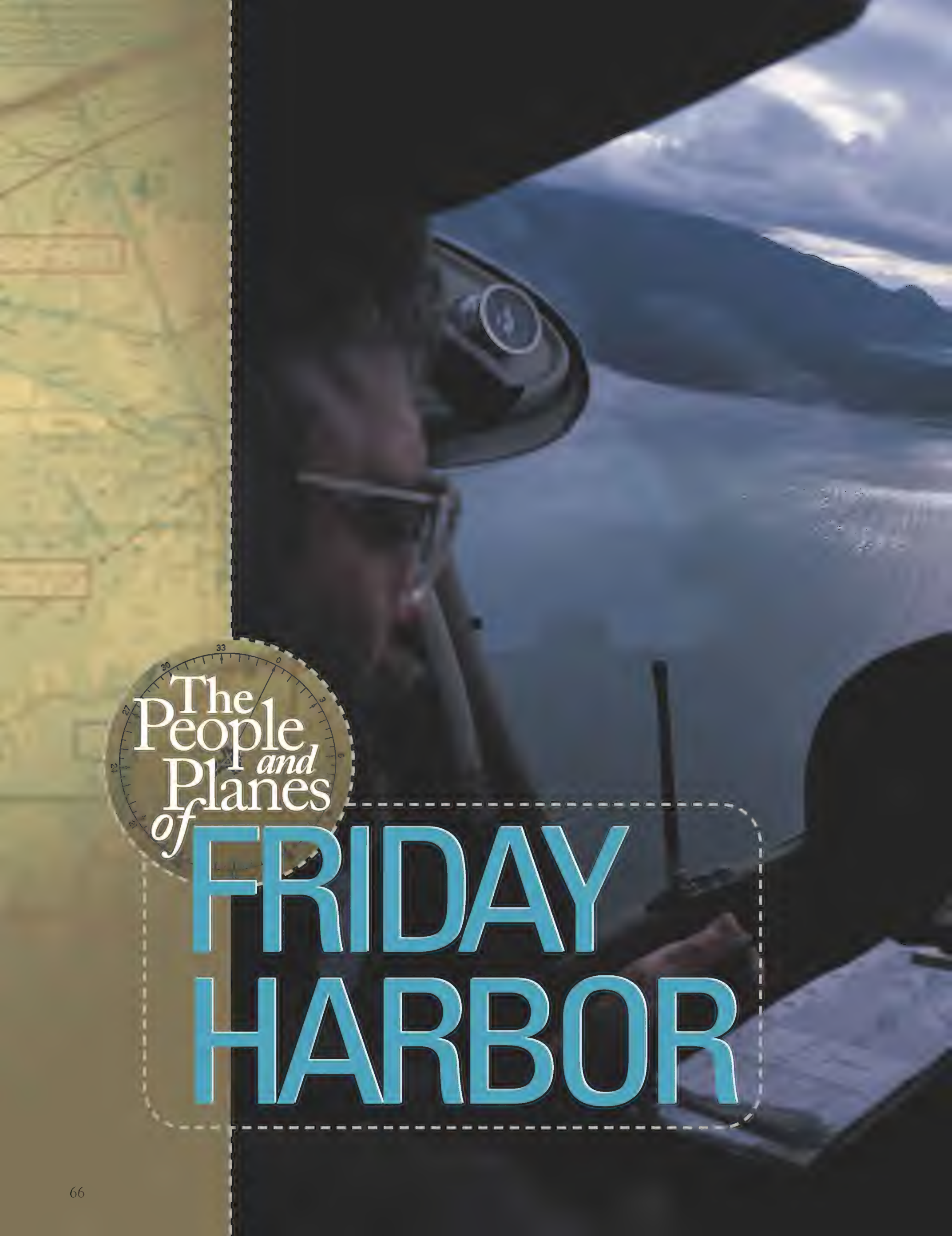
After the Vietnam war, the Louisiana Department of Wildlife and Fisheries acquired some of the YO-3As, using them for several years to catch poachers. Most of the aircraft were bought by the FBI, which used them for about a decade for surveillance. Today NASA owns one YO-3A, currently mothballed, for making acoustic measurements of other aircraft. Most are in museums, and one is in a private collection awaiting restoration.

The two original QT-2s were sent to the U.S. Naval Test Pilot School at Patuxent River, Maryland. The school had already bought some Schweizer 2-32 sailplanes and designated them X-26As, to appear to be experimental, even though they were not, in order to

get around complicated procurement regulations. The QT-2s were redesignated X-26Bs, and their strange front pylons turned out to have a practical use after all, giving student pilots a chance to learn at very low speeds about yaw-roll coupling, which also affects supersonic jets.

The airplanes have a few direct descendants. Schweizer Aircraft of Elmira, New York, has produced its own quiet reconnaissance aircraft line. The Coast Guard, the CIA, the U.S. Air Force, and the governments of Mexico and Colombia have used Schweizer's single-engine RG-8 and pusher-puller twin-tail RU-38 to spot drug smugglers at night, and to electronically eavesdrop and monitor ground events without being detected. But Schweizer's quiet planes don't fit the modern definition of stealth, which has come to refer to radar instead of sound.

Compared to the manned and unmanned reconnaissance aircraft of today, the QT-2s and YO-3As were primitive. Evolution has passed them by, and they seem like some exotic, long-extinct species. Their claim to history is not their effect on the Vietnam war, which was slight, but their early role in the developing stealth field and their exploitation of the physics of sound. Other means were found to accomplish the quiet birds' purpose, and in wars fought today, U.S. military forces own the night. ➔



The
People
and
Planes
of

FRIDAY HARBOR

Are pilots drawn to the San Juan Islands because of beautiful weather, a friendly little airport, or the legend of Ernest K. Gann?

by Tom Harpole • Photographs by Phil Schofield

In 1948 Roy Franklin established scheduled flights from Friday Harbor, a tiny fishing village on San Juan Island, to Seattle and a few other airports on the Northwest coast. His home airfield, the 80-year-old pilot recalls, was a cow pasture on a neighbor's farm, ice-crusted in winter, unlit, and congested with mounds of dozing cattle. In an unpublished memoir, he tells of his heart hammering against his ribs every time he felt his way back down to that field in a four-place Stinson 108 while his wife Margaret Ann sat in the family car, children bundled in the back seat, trying to illuminate the pasture for Roy's night landings. "I learned pretty quickly that you shouldn't buzz the middle of a herd of cows and separate them," Roy recalls, his hands and beefy arms flying in front of his barrel chest, in the aviator's universal simulation of flight. "You want to get alongside them and push them as a group away from where you want to land or they'll just bunch up again."



Airport founder Roy Franklin recalls a special moment for a rescue of injured Sequoia Redstart. Bushman he flew on mail runs in the 1960s. Franklin's friend, author Ernest Gann, also took a liking to the seaplane and provided the parking for Friday Harbor Mall. The Bushman still flies.

A cow pasture was not the future Franklin had imagined when he moved from the mainland to fly small transports in the San Juan Islands. He had worked for six years without a single day off, and even so, he could have gone broke had he bent a propeller. He decided he'd have to find a way to build an airport with a lighted, hard-surface runway, a heated hangar, and a fueling facility. In 1954 he made a down payment on 66 heavily timbered acres a half-mile west of downtown Friday Harbor, and he spent two back-breaking years cutting a hole in the forest for a 2,300-foot runway. Help from his dad and a U.S. Forest Service contract to fly fire patrols got him to the point where he could buy Island Sky Ferries (ISF), the operation that had employed him, and its two Stinson 108 Voyagers. The Franklin family always maintained that "ISF" stood for "Insufficient Funds."



MAP: JUAN THOMASIE

Through the windscreen, a typical San Juan Islands view: clouds, sunlight, and a small rural airstrip.

The Details



THE SAN JUAN ISLANDS lie in the Strait of Georgia, between Canada's Vancouver Island and Washington state. On the westernmost of the four large islands, Friday Harbor can be reached by ferry or small airliner. For travel information, visit www.guidetosanjuans.com.

MAP: JUAN THOMASIE

Franklin held on through the booms and busts of the 1960s and '70s, acquiring more aircraft, selling them off, merging with several small mainland-based lines as San Juan Airlines, and later dissolving the mergers. He held on to the airport until 1983, when he sold it to the Port of Friday Harbor with the stipulation that the buyers never change the name to Franklin Field, a name they had considered.

Today, hundreds of private pilots and several small airlines fly in and out of the airport that Roy Franklin built. Though the town of Friday Harbor is still small (population 2,045), San Juan Island and the other scenic islands in the archipelago have been developed into summer resorts, havens for boaters—and pilots. San Juan County, which comprises the four large islands—San Juan, Orcas, Lopez, and Shaw—and 168 others, if you count at low tide, has one of the highest concentrations of pilots in the United States.

"We've got a lot of line pilots who retire here because they've flown to Seattle or Salt Lake from Asia or Anchorage and they usually see a hole in the clouds over the San Juans," says Ray Bigler, president of the 67-member San Juan pilots association.

When Bigler says "a hole in the clouds," he is speaking literally, describing a weather phenomenon that bestows on the islands an average of 247 days of sunshine a year. Frequently the islands are sunny when the coasts of Washington and British Columbia—and even southern Alaska—are socked in with fog or rain. The islands get less than half the rainfall of Seattle.

"Rain shadow," says Dodie Gann, the widow of the best known line pilot ever to have retired to the San Juans. Her husband, Ernest K. Gann, wrote several of his 16 books from the comfortable farmhouse the two shared a couple of miles outside Friday Harbor. Dodie Gann has the handshake of an athlete and exudes the self-assurance it took to hurtle down Olympic ski slopes in 1948. Last October she once again, at 80, passed her flight physical. She talks weather with gestures that sweep out over her dining room table. "Lows from the Pacific and down from Alaska butt up against the Olympic peninsula west of us and go counter-clockwise and dump a bunch of rain and make their way inland and butt up against the Cascades and dump more, and they come back at us depleted, from 140 degrees." She regards her non-pilot audience and adds, "From the southeast."

Weather on the mainland is good enough for the islanders to fly frequent errands there. "I make Costco runs once a week with a couple girlfriends, or head over for lunch, or just fly to be flying," Gann says. "We can be in Bellingham [Washington, 10 miles south of the Canadian border] in 20 minutes."

Ray Bigler and his wife, Julie Palmer, fly their Cessna 182 on errands to the mainland as well, frequently for what Palmer calls "retail therapy." Bigler's favorite flying is with the Eagles, a group of roughly 40 volunteer pilots who fly cancer patients to the



Pilot and sailor Lee Brewer pushes his de Havilland Tiger Moth Old Harry back into its coveted airport hangar (right).

mainland for treatment. "We pick them up and take them to the airport and fly them to the mainland and drive them to the hospital and wait and take them all the way home," says Vicky Thaliker, a pilot for 30 years who organizes the group.



COURTESY ROY FRANKLIN

and a fleet of Cessnas and Piper Navajos, San Juan Airlines operates three scheduled round trips a day between the islands and the mainland. "In summer we fly a lot of families who want to go out on Thursday and come back on Sunday," says Chris Pagnotta, the 31-

year-old director of operations. "It's a one-and-a-half- to two-hour ferry ride versus a 10- to 12-minute flight for \$35. There's a lot of development on the islands, and lately we've been flying a lot of workers—plumbers, carpenters."

Pagnotta says they fly the winter traffic in sometimes less-than-ideal conditions. "Most of the time it's calm and beautiful," he says, "but throughout the winter, the weather is not always so friendly. With low ceilings and low visibility, the flying is extremely demanding. We're following shorelines and weaving around through the islands. You can't cross over the islands. People think: *Islands. Flat plates sitting on the water.* But on Orcas Island, for example, the elevation changes from sea level to 2,500 feet in about a mile, and if the clouds are sitting at six or seven hundred feet...."

Kenmore Air Harbor is a large seaplane operation flying de Havilland Beavers and Otters between the San Juans and ports near Seattle. Ask the pilots for hangar tales and they rarely reply with stories of close calls flown in winter weather. They talk about movie stars. Friday Harbor's Pat Mayo can also tick off a list of celebrities who have shown up there: Kurt Russell and

Friday Harbor, coming and going: Beyond today's runway (above), a ferry approaches the docks. In 1963 from the opposite point of view (left), the runway enters the photograph from the upper left. At 30 feet wide, it's barely more than a road. "It kept you on the ball," says Franklin, who also cut a grass landing strip through the trees, visible at the top center of the photo.

"It's very hard on these [patients], but you get to fly with some very dignified people." The trip by air is faster and more comfortable than the expensive, awkward, all-day ordeal it becomes if undertaken by ferry and taxis.

The inconvenience of waiting for ferries is one reason Friday Harbor Airport is so important to the San Juan community. Pat Mayo, a thin, philosophical man of 57, has managed the operations at the airport for 21 years. His office perches in an octagonal control tower, a structure he acquired as surplus and had barged to the island and mounted on the new operations building. He enjoys a 360-degree view of the airport as well as the San Juan forests and Puget Sound. "Our lawmakers underfund [the ferry system] chronically, even though it's a critical link to the population of these islands and the Olympic peninsula," Mayo says. "There aren't enough ferries. You show up an hour early and still can't get your car on." Ferries connect the four largest islands with mainland cities, and though many islanders use their own boats for pleasure trips to the mainland, the fastest and simplest way to cross is by airplane.

With 10 pilots, five de Havilland Beavers,



For airport manager Pat Mayo, there's nothing better for keeping an eye on things than an office converted from an old control tower. Right: Is it the inconvenience of ferries or the magnificent views that make island dwellers take to the skies? Roy Franklin's son Ken flies his Robinson R44 near Orcas Island.



Goldie Hawn, Patrick Swayze, Art Linkletter, Tom Cruise, Sandra Bullock....

"One of my most memorable flights was taking Katharine Hepburn to the islands," says Kenmore president Gregg Munro. "She was in Seattle doing a play, and she went to Friday Harbor for lunch. She was an older lady with a walking stick, but as the day went on, she just got younger—climbing over logs and rocks on the beach."

Munro prefers seaplanes to land planes, he says, because "basically it's one of the last unrestricted areas of flying, going where there are no control towers."

Both Kenmore and San Juan fly charter flights to the "outer islands," as the locals call them, where there's no ferry and the residents depend on airplanes for services



C. MARIN FAURE

and deliveries. "When we fly to the smaller islands, we're usually taking [someone from] the phone company, or a package for FedEx," says Jackie Hamilton, the owner of on-demand charter service Island Air, which is based at Friday Harbor. Hamilton's dad moved the family to the islands when he retired from Pan Am. "Pilots tend to find the garden spots," she says.

Air deliveries to the smaller islands earned the San Juans a spot in the *Guinness Book of Records* for the world's shortest scheduled airline flight, less than a minute. West Isle Air notified the Guinness organization of the flight, between Center and Decatur Islands, which was on its mail run. Jack Kintner, an ordained Lutheran minister, who flew his parish's Cessna 172H from Friday Harbor to Lopez Island to Orcas for Sunday services at 10 a.m., noon, and 2 p.m., had previously flown the mail for San Juan Airlines and knows the route. "It was a lot of fun to try to do it as fast as you can," he says. "There were guys who'd sit out on their porches and time us from one island to the other."

Though few of the island flights are that short, none is very long. Flying from Friday



Vital Stats

FRIDAY HARBOR AIRPORT

3,400-foot runway;
45 spaces for guest
aircraft

Dining: The locals say the best food is at Cafe Vinny's (Italian) and the best view is from Downriggers. There are 25 restaurants in walking distance of the airport—and 22 espresso machines.

Don't Miss: The 20th Annual Orcas Island Fly-in, this August 6 through 8, or a trip on one of the commuter lines, whose pilots will divert for whale sightings.

Web site: www.portfridayharbor.com

Harbor to Seattle takes only 40 minutes even in the smallest single-engine Cessna. Ray Bigler has 300 hours but he says he has as many takeoffs and landings as pilots with a thousand hours. "In six to eight hours of flying," says Chris Pancotta, "you make 30 to 40 landings."

The short flights typical of San Juan flying can create mechanical problems. Sid Smith, San Juan Island's only FAA-certified mechanic, replaces a lot of batteries, starters, and magnetos. "People fly short distances, a lot of 15- and 20-minute flights, so [parts] don't last as long, and valve guides go through a lot of temperature cycling and wear out sooner," he says. Because of the salt spray that comes off Griffin Bay, Smith also uses a lot of anti-corrosion coating. "You can tell which way a plane is parked on the ramp or an open T-hangar because one side gets corroded," Smith says.

With the changing demographics of the San Juan Islands, charter services and flight instruction outfits are proliferating, but the heaviest use of Friday Harbor Airport is by day trippers. On the first day of a three-day summer weekend, the airport sees 240 operations during daylight hours. Although

there are 30 airfields within a 10-mile radius of the airport, pilots choose Friday Harbor because of its ample parking and because they can walk to any of a half-dozen good restaurants or to a seaside that offers glimpses of seals, whales, and a variety of birds. "Lots of pilots like to eat and then stroll through the marina," Mayo says.

"You can watch the seaplanes coming and going," says Russell Williams, a Microsoft programmer who lives in Issaquah, Washington. Williams, who has a collection of four classic tail draggers and four "projects" awaiting restoration, flies his 1958 Bellanca Cruisemaster to Friday Harbor on several of the long days of the northwest summer. "I can leave work by four or five, hop in the Bellanca, and fly up to [San Juan] island or wander around the islands. It's a fun flight either way.

"The part I like better is to come back to Seattle around dusk. You can see for a hundred miles. The Cascades are on your left in the east and the Olympics are on the right. Then the sun goes down on the Olympic peninsula and everything lights up. Mount Rainier turns pink in the distance."

Another Friday Harbor regular, retired Air

De Havilland Beavers are an indigenous island species. Kenmore Air Harbor began flying them in 1963.



A Cessna 172 making a final approach to Friday Harbor skims over St. Francis Catholic Church. Right: Headed home from lunch with friends, Dodie Gann tunes her radio to the Bellingham tower.



Force pilot Lee Brewer, is one of a few dozen lucky pilots who have hangar space at Friday Harbor Airport, which, according to Pat Mayo, has a 27-year waiting list for hangars.

The 79-year-old Brewer rolls back his hangar's heavy doors and wheels out his 1,200-pound 1937

Tiger Moth biplane. Brewer flew B-29s in the Pacific theater and jet fighters in Korea, and later spent years stationed in Germany and France. His Tiger Moth is equally peripatetic, having been built in Hatfield, England, in 1937, subsequently shipped to Australia to be used as a wartime trainer, and later bought by the South African air force. In 1975 it wound up in Canada, where Brewer bought it. He had also owned a Ryan PT-22, but shortly after taking off from Anacortes, Washington, in May 1992, a counterweight on the crankshaft came off and the engine literally blew up. As it seized, debris from the no. 4 cylinder tore off chunks of his prop. He glided to a landing on Highland Drive, near the airport, and the airplane burned. "End of a good plane," he shrugs.

Besides the Tiger Moth, Brewer owns *Rain Bird*, a 40-foot schooner built in 1949 by William Garden, perhaps the most exclusive boat designer on the West Coast. (Brewer's expensive tastes extend to his cars: a 1948 Lincoln Continental Cabriolet and a replica of a 1927 Bugatti model 35B that he built himself without plans.) The weather in the San Juans provides him with lots of opportunities to fly, but when he can't, he works on his boat or goes sailing. "Landing or tying up, either way you know you're done dealing with Mother Nature on her own terms and it's a big letdown," he says.

"Hard by the Canadian border and off the Washington coast there lies an archipelago known as the 'American San Juans,'" Ernest Gann wrote in 1974 in *Ernest K. Gann's Flying Circus*. "Islanders set their clocks by the initial growl of the 450-horsepower Wasp with which the Stinson Gull Wing is now powered. About the time the island farmers are finishing their first quota of morning chores, the Gull Wing is returned with the mail. Most islanders take its departures and arrival for granted unless they happen to become involved while it is performing its secondary role as an ambulance plane. Even Roy Franklin, pilot-boss of San Juan Airlines, has lost track of the number of about-to-be mothers rushed to the mainland."

Franklin does remember the night he flew three women on three separate trips to the mainland to deliver babies. "It was in the days after World War II," he explains. "Everybody was having babies after the war." A few days later, he had seven people in his Stinson Voyager: all three mothers and their new babies flying home. Small aircraft still carry folks to the mainland for medical attention, and the mail is still delivered in an old transport on its *n*th career with its *n*th owner. Today it's a twin-engine Beech 18 operated by Methow (pronounced "MET-how") Aviation. But Friday Harbor has more fancy restaurants and B&Bs and a thousand more people than it did when Franklin's outfit was flying the mail, and many more pilots coming through the airport.

Sixty percent of the people in Friday Harbor have lived there less than five years. Locals still give out four-digit phone numbers, but the community has lost some of its small-town intimacy. "An airplane engine used to be music to folks' ears," Mayo laments. "In Roy Franklin's day it meant a medevac or a long-awaited trip to the mainland. Now they're considered a nuisance and we have some knock-down-drag-out battles over noise. We have to pay attention. Dozens of airports have been shut

down over noise. All the local pilots really try to tiptoe in and out. Blair Estenson, the guy for Methow Aviation who flies the mail in at 5:30 a.m. in the Beech 18—all you hear is his tires meet the ground.” Estenson confirms that he pulls the power way back “to keep the neighbors happy.”

But the noise from an airport averaging 65,000 ops per year can be intrusive, so Mayo treats seriously every noise complaint that comes in. “We bought up all the adjacent ground we could to keep people from moving in,” he says. “Plus we need the ground to build more hangars.”

Locals and frequent visitors practice noise abatement by flying to line up with the runway via a series of right turns that keep aircraft over less populated areas. But since the airport has no air traffic control, there is no one to guide newcomers in. “Sometimes a pilot comes in without making radio contact, or they’re on the wrong frequency and they don’t know to come in on right turns,” Mayo explains. “I can’t tell them what to do, but usually, once they’re parked, someone mentions the frequency and tells them about our noise abatement.”

The airport, says Mayo, is caught in something of a paradox. Transient pilots like what they see, and many have moved to Friday Harbor. “The airport contributes a lot to the local economy, but it also is partly to blame for the way the town is

changing,” Mayo admits.

Visitors can still find traces of the old Friday Harbor, according to Island Air owner Jackie Hamilton, who moved to the islands right after high school. It’s still “the classic small town,” she says. Hamilton doesn’t bother to advertise her business, because she knows that if somebody needs a charter or is interested in flight instruction, the word will travel—or she’ll run into the potential customer in the grocery store.

There’s also a certain continuity in Friday Harbor because people who move to the San Juans tend to stay. Originally from New York, Chris Pagnotta began flying in the islands in 1995. “I’ll never leave,” he says.

“The word ‘freedom’ comes to mind,” says Gregg Munro, explaining why he chose flying seaplanes in a place like the San Juans instead of seeking a job with one of the major airlines. With all the growth surrounding it, Friday Harbor is still an airport of small airplanes, short flights, uncontrolled airspace, and pilots who just want to be in the air over one of the most magnificent island chains on Earth. ➔

Jack Kintner flew in the islands for 20 years, part of that time as a pastor serving parishes scattered among three islands. Bottom: A Cessna 208 Caravan awaits a load of nine passengers at the Friday Harbor passenger terminal.



▶ SIGHTINGS ◀



ERIC LONG

A Douglas DC-3 got an extreme makeover last year from a group that enables gravely ill children to participate in art projects. Dan Gryder of Griffin, Georgia, loaned his 1938 airliner to Portraits of Hope, which provided young hospital patients with unique paint brushes that allow disabled artists to create huge flower decals. The children signed their work, and they received foam gliders and paint to could create their own flying art.

In a hangar that had been provided by the North Carolina Department of Transportation, volunteers put the 100 flower decals on the airplane. The result: a DC-3A that might have been Austin Powers' very own shag-a-delic transport brightened the skies over Kitty Hawk, North Carolina, during last December's Centennial of Flight celebration. After the six days it was on display at the centennial, the decals were removed and the airplane went back to its day job, training pilots for their DC-3 type ratings and offering jumpseat rides to wannabe pilots. Gryder's transport, registration N143D, had first flown for SwissAir, then Ozark. In 1974 it was converted to a freighter.

Dayton Daily News photographer Ty Greenlees describes the set-up that enabled his photograph (opposite): "After a lengthy preflight briefing involving six airplanes and four photographers, we decided to forgo a large formation and opted for two airplanes, a Cessna O-2 Skymaster camera plane and the DC-3. We planned the flight for the last hour of sunlight, for its visual warmth. I was thrilled at how brilliant the flowers appeared as we flew over the broken shoreline of Roanoke Sound. The shoreline gives just enough contrast to the rippled water without detracting from the airplane."

Says Eric Long, whose photograph appears above: "Learning the significance of the artwork, the children who painted it, and seeing their signatures up close, I felt a bond with the children, whose disabilities may prevent them from flying but who want to share the experience of flight with all."





TY GREENLEES

War Paint

Combat in the Sky: The Art of Air Warfare

by Philip Handleman. MBI Publishing, 2003. 203 pp., \$40.

After all these years, I've now begun to understand the appeal of aviation art, thanks to the paintings in this wonderful book—and thanks also to the accompanying photos and text.

There are 89 paintings altogether, from such practitioners as Jim Dietz, Nixon Galloway, Roy Grinnell, and Gil Cohen, to name just four of the 15 artists whose work is shown here. (And no women. Perhaps aviation art is a guy thing?) The paintings are arranged chronologically, so as to give the history of combat aviation, with an emphasis on World War II.

Most important, the paintings are tied together by Philip Handleman's intelligent, insightful, and enjoyable text. He describes an RC-135 surveillance aircraft, with its bulbous antennas, as looking "as though it suffers a case of mumps." Writing of the temptation to use a Tomahawk against a petty offender, he quotes a historian who likens the cruise missile to modern courtship: It provides the president with "gratification without commitment," and thus might be used more often than is strictly necessary.

In both cases, Handleman is actually describing a photograph, not a painting: 64 more illustrations come from the camera rather than the brush. And the number of photos is actually one less than I'd thought at first: In a marvelous bit of *trompe l'oeil*, Sam Lyons re-creates "The Ride Back" of a Huey helicopter in Vietnam, which turns out to be a black-



U.S. P-38 ace Thomas McGuire's downing of a Nakajima Ki-43 Oscar over Jefman Island in the Pacific is captured in Nixon Galloway's "McGuire Scores His 19th."

and-white painting, as camera-perfect as the nearby photograph.

The author is a pilot, warbird owner, television producer, and a prolific writer and photographer. (One of his photos—the Air Force Thunderbirds in diamond formation—appeared on a 1997 postage stamp, and another will be so honored this year.) *Combat in the Sky* will, I suspect, be the best known of his works. The book is sized for the coffee table and handsomely printed. You'll turn to it for the sumptuous reproductions, then again for the stories it tells about the history of air combat.

For me, the painting with the greatest punch is Rick Herter's "Ground Zero, Eagles on Station," which, like the Huey painting, tricked me at first

glance. I took it for a view of Baghdad being pounded by U.S. air power in 1991 or 2003. But no, the city is Manhattan, and the day is September 11, 2001. It's a reminder that aviation art can depict real people dying.

—Daniel Ford's most recent book is *Michael's War, a story of the Irish Republican Army*.



One Giant Leap: Neil Armstrong's Stellar American Journey

by Leon Wagener. St. Martin's Press, 2004. 431 pp., \$25.95.

Behind that potent image of Neil Armstrong's first steps onto the dusty lunar surface in 1969 lay years of experience, agony, aspiration, and struggle. In *One Giant Leap*, Leon Wagener narrates this lifetime of labor through the biography of a down-to-earth man on the moon, Neil Armstrong, whose simply-led life happens to encompass the most awe-inspiring moment of the 20th century.

The moment culminated a career in high-performance aviation, and Wagener is at his best when recounting Armstrong's pivotal experiences: the air war over Korea, testing aircraft at NASA's Dryden flight research center in California, the near-calamity of Gemini 8, and the life-or-death maneuvers he undertook as he



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BRIEFLY NOTED

Comm Check... The Final Flight of Shuttle Columbia

by Michael Cabbage and William Harwood.
Free Press, 2004. 336 pp., \$26.

Comm Check takes its title from the last transmission mission controllers made as they tried repeatedly to reestablish contact with the crew: "Columbia, Houston, UHF comm check." But by then, what remained of *Columbia* was raining down over Texas and Louisiana.

Cabbage and Harwood, both veteran shuttle reporters, meticulously researched e-mails, transcripts, memos, recordings, and the Columbia Accident Investigation Board report and conducted numerous interviews with key players to piece together a poignant yet riveting detective story.

The saga opens with *Columbia's* fatal descent interwoven with the dreadful realizations that plagued mission controllers when sensor data began to fall off. The authors detail the discussions—and the lack of discussions—between engineers and mission control people as to what damage the foam strike to the orbiter's wing might have caused. Like the investigative board, Cabbage and Harwood do not so much blame anyone as lay the cards on the table and let the reader decide where the blame may lie. *Comm Check* is a comprehensive, layman-friendly account that is hard to put down, even though we know how the story ends.
—Patricia Trenner, *Air & Space/Smithsonian* senior editor, was a member of the Columbia Accident Investigation Board editorial team.



sought a safe site in the Sea of Tranquility. Wagener is a skilled raconteur, and anyone interested in aviation history will find his stories of Armstrong's experiences rewarding.

The author succeeds at telling the story of Armstrong's early life, his straight-arrow school experiences, his engineer-like approach to marriage, and his unwavering focus on aviation. Armstrong's space trips are similarly well described, and Wagener follows the moonwalker's story long after reporters' attention spans were exhausted, to chart the trajectory of Armstrong's complex life after the Apollo period.

When he strays from recounting Armstrong's life, the book falters. Frequently the narrative drifts from Armstrong to survey his cultural and historical context. These excursions are rarely insightful. Often they are little

more than clichés, and would have benefited from retooling or excision. In addition, further editing would have remedied occasional stylistic blemishes, but these seldom eclipse the grandeur of the subject matter.

A generation later, the odysseys of 2001 have eluded us. We have no pin-wheeling space stations, no lunar colony, and small prospect of interplanetary travel in our lifetimes. What, then, is the lesson of Neil Armstrong? *One Giant Leap* teaches us valuable lessons about how a life can be lived amidst chaos and still achieve things out of this world.

—Thomas Mullen has reviewed aviation and astronomy books in a number of publications.

Tango Midnight

by Michael Cassutt. Forge, 2003.
284 pp., \$25.95.

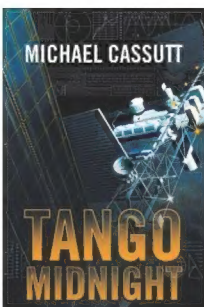
Michael Cassutt's latest novel is something of a sequel to *Missing Man*, in which he imagined that NASA was suddenly called to respond to a horrible situation: dealing with a suicidal astronaut. Compared with that book, which was written in the long period between the *Challenger* and *Columbia* accidents, *Tango Midnight* goes much further into the thought processes of those charged with reacting to an emergency in space. *Tango Midnight*, released into a post-*Columbia*, post-9/11, post-anthrax-threat world, is more somber and mature than its predecessor.

The premise of *Tango Midnight* is simple: Research on a deadly virus goes awry on the International Space Station. An accidental release of the virus calls for quickly working up a rescue plan and quickly implementing it. And, of course, nothing goes as planned. There are also some interesting plot twists of a geopolitical nature that I will leave the reader to discover. Hint: Think China.

Throughout the book, Cassutt's characters and caricatures hit eerily close to the mark. There is the powerful NASA center director who is suddenly removed from his job (as happened to Johnson Space Center director George Abbey) and makes an attempt to rehabilitate himself.

There is the multi-millionaire who is going to fly in space regardless of what anyone else thinks (à la Dennis Tito). And there is the wide range of astronauts and cosmonauts, running the gamut from boy scout to bad boy.

I had to make a few intellectual



adjustments as I read. Having once worried about toxic spills aboard the ISS when I was a NASA payload accommodations manager, I found the notion of placing a hazardous virus on the ISS rather unlikely. That said, there is certainly more than enough aboard an orbiting laboratory that could go wrong and end up triggering scenarios similar to those in the book. Cassutt masterfully illustrates both the contingency plans that would fall into place and the way government officials and NASA staffers would respond as their friends and co-workers risked death.

Cassutt writes about manned space exploration as it is actually practiced. His style is to immerse the reader in the lingo, jargon, and curious speaking manner one hears at NASA, but he also gets you nicely inside the motivations of his main characters without overdoing it. He depicts NASA as a place where highly talented people are beset with the pressure of being perfect day in and day out. All of these things make *Tango Midnight* a great ride.

—Keith Cowing is the editor of NASAWatch.com and SpaceRef.com.

NEW MUSIC

To Touch the Stars

Prometheus Music, 2004. Available from www.prometheus-music.com, \$15.97.

Music inspired by space is nothing new, from Holst's *The Planets* to Brian Eno's sublime *Apollo*. So what are we to make of *To Touch the Stars*, a collection of 17 songs by different groups, all inspired by the theme of space exploration?

The songs range from the folksy "Witness Waltz," about watching shuttle launches, to soft-rock anthems like "I Want to Go to Mars" and the surreal "Dog on the Moon" ("This dog was not any regular rover/This was the dog they made all that fuss over/[T]he first dog to walk on the moon"). They are all performed with verve and sincerity, but the album as a whole tends towards accidental self-parody. It sounds like a space version of *A Mighty Wind* or *This is Spinal Tap*.

Touch the Stars did grow on me over time, and its good intentions almost wore down my cynicism. It might even be good for astronaut karaoke or a space-theme party. Listen to the samples on the Web site, and if they appeal, buy the album. But get Eno's *Apollo* first.

—Matthew Stibbe



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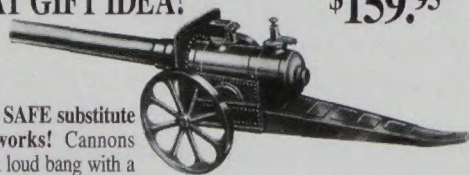
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Air & Space/Smithsonian magazine is now available on audio tape for members who cannot read standard print due to disability.

For the basic membership fee, you will receive a print copy of the magazine plus the audio version. If you or someone you know has been struggling with the standard print version because of vision loss or other disabilities, contact the Smithsonian Accessibility Program at 1-888-783-0001 and receive your next issue of *Air & Space* on tape.

CALENDAR

April 10

Open Cockpit Day. Get an up-close view of numerous World War II aircraft. Commemorative Air Force Headquarters, Midland International Airport, TX, (432) 563-1000, ext. 2231, www.commemorativeairforce.org.

April 13–19

Sun 'n Fun EAA Fly-In. Lakeland Linder Regional Airport, FL, (863) 644-2431, www.sun-n-fun.org.

April 15

"Around the World in 39 Days: Fantastic Adventure." Schirmer Riley will discuss his experiences flying a 1958 Piper Comanche around the world. Virginia Aviation Museum, Richmond International Airport, (804) 236-3622, vam.smv.org.

April 24

New England Aviation Expo. A day-long program designed to educate and promote the safety of general aviation pilots throughout New England. Daniel Webster College, Eaton-Richmond Center, Nashua, NH, (603) 879-6807.

April 30–May 2

Georgia Wings Weekend. Gwinnett County Airport, Briscoe Field, Lawrenceville, GA, (770) 613-9501, www.wingsweekend.com.

May 1

Early Jet Aircraft Seminar. Planes of Fame Museum, World War II Cal-Aero Field, Chino, CA, (909) 597-3722, www.planesoffame.org.

May 2

Nike Missile Museum Open House. Fort Barry, Sausalito, CA, (415) 331-1453, www.nikemissile.net.

May 15 & 16

Airshow 2004. Planes of Fame Museum, World War II Cal-Aero Field, Chino, CA, (909) 597-3722.

May 20–23

Reunion: Personnel associated with the F-104 Starfighter. Pueblo Weisbrod Aircraft Museum, Pueblo, CO, (719) 948-9219.

May 29 & 30

Salute to Veterans Airshow and Celebration. Columbia Regional Airport, MO, (573) 443-2651, www.salute.org.

World's Smallest Airshow. Ultralight demonstrations, skydivers, radio-controlled airplanes, and classic cars. Brian Ranch Airport, Llano, CA, (661) 261-3216, www.brianranch.com.

Organizations wishing to have events published in *Calendar* should fax press releases two months in advance to (202) 275-1886 or mail them to *Calendar*, Air & Space/Smithsonian, MRC 951, P.O. Box 37012, Washington, DC 20013-7012.

CREDITS

Our Little Water World. David Holroyd and Rod Parker plan to fly an ultralight from England to Australia next year.

Landing in a Bowl. Stephen Joiner writes about obscure aviation history from Southern California.

Crater Face. Tony Reichhardt is a consulting editor at *Air & Space/Smithsonian*.

Airshow Lite. *Air & Space* senior editor Patricia Trenner loves airshows of all flavors—particularly those that serve pizza for breakfast.

Supporting Cast. Roger A. Mola covers the airshow industry for *Air & Space*, *Aviation International News*, and the International Council of Air Shows.

"I Got Shot Down." What surprised Phil Scott about the pilots he interviewed was how eager they were to tell their stories. Says Scott: "I expected them to be laconic, but when I asked them the first question, they talked for an hour."

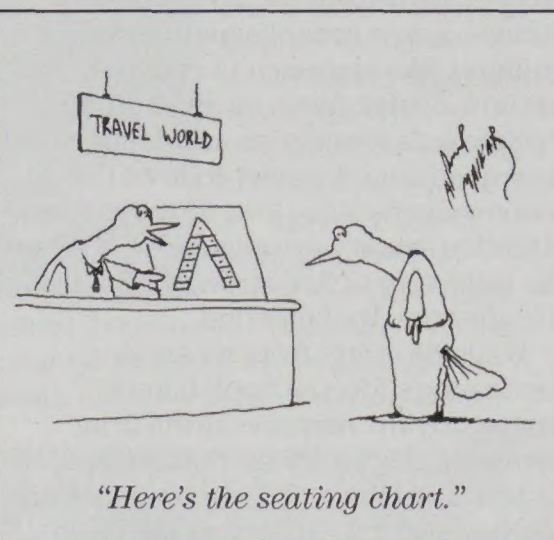
Restoration: Alpine Air. Linda Shiner is the executive editor at *Air & Space*.

Retro Rocketeers. James Oberg spent 22 years working at NASA mission control in Houston and is now an author and lecturer on spaceflight. His Web site is at www.jamesoberg.com.

Night Stalkers. Roger Warner is a journalist and historian who lives in Massachusetts.

The People and Planes of Friday Harbor.

Tom Harpole, a freelance writer in Montana, is a frequent contributor to *Air & Space*. He has kayaked extensively around the San Juans but couldn't live there for the lack of snow.



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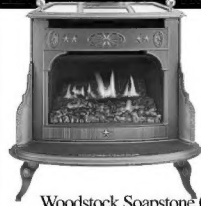
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Not every issue of the magazine is available. For a list of editions that are out of print, check the Web at the above URL.

ON THE WEB SITE

www.airspacemag.com



COURTESY LES HORN

The very quiet YO-3A was able to sneak up on the Viet Cong.

For more about the Lockheed YO-3A, the silent airplane of "Night Stalkers" (p. 58), visit the Web site and the Hiller Aviation Museum in San Carlos, California, which has one of the aircraft in its collection. Other feature articles about the Vietnam War, from the series "Vietnam Memoir," are also available online. On the home page, click on "Feature Articles Online" and look for "Special Series."

FORECAST

In the Wings...

All Guts, No Glory

In the nation's haste to fend off attacks in World War II, the U.S. Navy sent into battle light escort carriers...and paid a heavy price.

Third in a Series: The People and Planes of Spruce Creek

Welcome to a neighborhood where a hangar is home.

The First Thousand Days

Although most of Earth hasn't noticed, astronauts aboard the International Space Station have assembled the laboratory, hosted tourists, hung on through tragedy, and created the first off-Earth culture.

Mystery Clipper

What happened that day in 1957 when Pan Am 944 went down?



NATIONAL ARCHIVES

The Liscome Bay was one of 50 escort carriers rushed into service during World War II.

Skyhawks Rule!

A word of advice from the pilots who fly the 1950s Douglas A-4 in mock dogfights against the Navy's frontline jets: Never underestimate Heinemann's Hot Rod.

To Saturn and its Moon

After a seven-year journey, the Cassini probe will enter orbit around Saturn this July, eventually send a craft to land on the planet's moon Titan, and finally reveal what Titan's smoggy atmosphere has been hiding.

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USAF

The Rockwell B-1 "Bone," which earned its nickname from a reporter's misinterpretation of "B-One," bagged a batch of new records last October.

B-1 Shoots, Scores

The U.S. Air Force put the pedal to the metal last October to set new records with its four-engine, swing-wing B-1. The long-range strategic bomber, built in the 1980s, already holds numerous records for speed, payload, and duration.

Over two days at Edwards Air Force Base in California, crews from the 419th Flight Test Squadron sent two B-1s on high-speed runs in four tasks: a 15- to 25-kilometer straight course and 100-, 500-, and 1,000-kilometer closed courses. (One kilometer equals .62 mile.)

The Day One crew stayed aloft for five hours; the Day Two crew, six. Each flight carried a full load of 84 bombs along with other hardware that added over 55,000 pounds. The first B-1 took on a heavy fuel load to attempt records in the takeoff-weight class of 150,000 to 200,000 kilograms. The second aircraft carried a lighter fuel load to qualify for the 100,000- to 150,000-kilogram class. Both were refueled in flight to enable all runs to take place during a single flight. (One kilogram equals 2.21 pounds.)

For the 15- to 25-kilometer event, each crew flew one pass in each direction over a 21-kilometer course at 15,000 feet, setting the speed record by averaging 828 mph in the heavy class and 807 in the lighter class.

For the closed-course events, the aircraft achieved a new record with speeds of 631 to 698 mph at 3,000 feet. (The B-1 can reach 900 mph at altitudes over 30,000 feet.)

The National Aeronautic Association sent a team of four to monitor the record attempts. Team director Richard Ionata, a retired airline pilot, says that several days in advance, with assistance from the Air Force, "we weighed both aircraft with three fuel loads to certify the accuracy of the fuel recording systems. The following day, we weighed six bomb racks loaded with bombs. We even weighed the crew members as part of our calculations."

Because the two B-1s were equipped only as test beds, there was no room for NAA observers, who relied on an inertial navigation system that records parameters 256 times per second, a computer that tracks fuel management and gross weight, and the aircraft's interface with the Global Positioning System.

In 1976, the NAA awarded the Robert J. Collier Trophy to the Air Force and Rockwell for development of the B-1. Cost considerations and other factors prompted Jimmy Carter to cancel the program in 1977, but Ronald Reagan revived it four years later.

—Stuart Nixon

Moments & Milestones is produced in association with the National Aeronautic Association. Visit the NAA Web site at www.naa-usa.org or call (703) 527-0226.

LOGBOOK

Nominations

The Harmon Aeronaut (Ballooning) Trophy is awarded annually for the most outstanding international achievement in the art and/or science of aeronautics (ballooning) from July 1, 2003, through June 30, 2004. Nominations are accepted through July 15.

The Elder Statesman of Aviation Award is awarded annually to honor outstanding Americans at least 60 years old who have made significant contributions to aeronautics. Nominations are accepted through June 30.

The Wright Brothers Memorial Trophy is awarded annually to a living individual for significant public service, as a civilian, to U.S. aviation. Nominations will be accepted from June 1 through August 31.

Nominations for the Katherine & Marjorie Stinson Award for Achievement may be made from May 1 through July 31. The award recognizes a living woman for an outstanding contribution, a meritorious flight, or a singular technical development in aeronautics or related sciences.

Public Benefit Flying Awards

The NAA and the Air Care Alliance have created a set of national awards that recognize the contributions of individuals and organizations to public-benefit flying. Visit the NAA Web site for award categories, criteria, and nomination guidelines. Nominations are accepted through June 30.

Events

The Robert J. Collier Trophy Banquet, which celebrates the 2003 winner of the aviation industry's most coveted award, will be held on May 19 in Arlington, Virginia. Check the NAA Web site for an upcoming announcement on the location.